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Putting up a meal for the owls

Growing guinea pigs for snake consumption

A Jungle Farm for Zoo Boarders

By James Anderson

THERE are many strange enterprises in the United States, but what is probably the only farm in the world whose crops are raised solely for consumption by wild birds and beasts is located on the outskirts of New York City. Little is known, even in the metropolis, about this curious "jungle farm" as it is called, yet it covers about fifty acres and has been in existence for some time. It has gradually become a vertiable clearing house for foodstuffs for more than 5,000 captive beasts, birds and reptiles hailing from all parts of the world who now live as one happy family in the fine New York Zoölogical Park.

Until the establishment of the farm, the provision of a bountiful and varied menu which would satisfy the residents of the zoo and keep them in good health the year round was a most difficult matter, particularly in the winter; but the products of the farm have solved this problem perfectly. Not only do these include all the various favorite foodstuffs, such as corn, carrots, beets, cabbages, turnips, potatoes, and other good things that delight the appetite of the vegetarians among the jungle folk, but the needs of the carnivorous beasts are also looked after. For this purpose there are several big breeding houses on the farm in which are raised large quantities of chickens, rabbits, guinea pigs, rats, white mice, pigeons, squabs and pigs—in fact, every kind of bird and animals used for food at the Zoo except horses and cattle.

The jungle farm was established because the open market of New York City, varied as its offerings are, could not be depended upon to furnish the large and varied lists of foodstuffs required to satisfy the finicky tastes of the feathered, furry and scaled Zoo boarders. Their food requirements differ far more widely than those of the human race. Aside from the necessity of keeping the Zoo specimens in perfect health, as far as can be done by a carefully studied diet, the Zoölogical Park has found that by operating the farm it saves about fifty per cent in the cost of furnishing the supplies. Further than that, there is never a chance of shortage, as a great reserve stock of food of all sorts is kept constantly on hand.

In many respects the jungle farm is a model one. Everything about it attains absolute hygienic cleanness. This is especially the case regarding the animal food furnished the carnivorous birds, animals and reptiles. Infection of every sort is guarded against most carefully, for every specimen in the great park has a definite value, and some of the birds and beasts are practically priceless. Owing largely to the care that is exercised in growing the food for the great collection of living creatures in the Zoo, and to the skill with which it is prepared and served, cases of illness among the "boarders" are very rare. Every day a farm wagon takes over to the Zoo a big assorted load of fresh vegetables and fruit. Piled on top are the boxes containing

Packing live rabbits for shipment to the Zoo

the day's supply of chickens, guinea pigs, rats, mice and other choice morsels for the meat eaters.

This daily supply of foodstuffs that comes from the farm is deposited upon the arrival at the Zoo with the cook, who arranges it in piles. The culinary end of the Park, including the kitchen and refrigerating plant, is about as large as that of a great hotel and as well equipped with pots, pans, big kettles and other up-to-date paraphernalia. Every ounce of food is weighed and measured and checked with the utmost precision. The quartermaster knows the individual taste of each one of the thousands of boarders. Some of the food has to be cooked so as to meet the requirements of certain appetites or the regulations of the Zoo's physician. In the kitchen there is a big steel range with its warming compartments and hot water appliances. All about are tables and meat blocks shining in clean whiteness. In addition to the range, there is a large double steam cooker for use in winter, when the steam heating plant is in operation. Everything is prepared in this kitchen from cornstarch blanc mange for a sick monkey to some huge portion for the jaded appetite of a finicky bear.

If an animal is in the hospital he is fed according to his case and diet. He may require broth or a few spoonfuls of orange juice or a combination of milk and eggs, cocoa and cup custard. In the great refrigerator there are forequarters of beef, tubs of fresh fish, clams on ice and dozens of beef hearts for chopping up into hamburgers. All this meat has to be cut just so. Some of the reptiles are fed in little cubes of exact size and some with small strips shaped like worms. Having no ability to tear their food they cannot swallow misfit pieces. All kinds of nuts are kept on hand, 650 or 700 pounds of beef, 200 pounds of fish, and 250 loaves of bread.

Shortly after the farm wagon arrives at the Zoo the keepers come to the kitchen with their pushcarts, load their allotted rations and return to the various buildings for the feeding. Here is a representative list of the live stock and the quantities of vegetables that are raised every year on the farm and fed to the great army of animal and bird boarders housed in the park:

2,600 chickens.	1,300 barrels carrots.
1,200 rabbits.	1,500 roots celery.
1,500 guineas.	3,000 lettuce.
800 mice.	2,000 cabbage.
3,000 rats.	5,000 ears corn.
2,300 eggs.	2 tons corn stalks.
50 pigs.	50 bushels tomatoes.
50 sparrows.	50 bushels turnips.
20 tons mangels.	50 quarts raspberries.
30 barrels potatoes.	50 quarts strawberries
900 barrels beets.	150 barrels grapes.

A special and luxurious menu has to be prepared for some of the rare and valuable tropical birds; for instance, the delicate and gorgeous plumed birds of paradise. They must be fed upon dainty fruits and berries, similar to those they once obtained from the trees in the New Guinea forests. Hence their food plate is filled to the brim with bits of sliced oranges, figs, bananas, grapes, raspberries and strawberries. The farm hothouses make this possible even in the seasons we poor humans not in the Croesus class have to forego such luxuries.

Giving the python a rabbit dinner

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Those Armor-Piercing Shells

WE have so often in the past felt called upon to criticize certain features of Mr. Daniels' administration of the great department of which he is the head, that it is with very real satisfaction that we extend our approval to his recent action in awarding a contract for armor-piercing shells to a foreign manufacturer. The Secretary's errors were in no small measure due to a system, in which a civilian with no previous technical training finds himself in charge of a department where he is continually called upon to pass judgment on matters of a highly technical character. Not even the most severe critic of the Secretary can deny that, in the past year or so, he has shown evidence of increasing appreciation of the inner spirit of the Navy, a more comprehensive grasp of the fundamental principles and the broad technical problems upon which it is based, and with which it is continually confronted.

The award of the contract for shells to a foreign maker has aroused an inevitable and bitter protest on the part of our own manufacturers; and, in sheer self-defense, the Navy Department has felt called upon, through its Secretary, to make known to the public certain inside facts in the matter, which we are free to confess have placed the Secretary in an unassailable position, by showing that he has been actuated only by a regard for the best interests of the country.

Simply stated, the facts are as follows: On January 3d of this year the Department opened proposals for furnishing the Navy with 16-inch and 14-inch armor-piercing projectiles. For the 16-inch projectile, the proposals were as follows: Bethlehem Steel Co. 4,000 in 36 months at $775 each; Washington Steel & Ordnance Co., 2,500 in 32 months at $750 each; Crucible Steel Co., 1,700 in 36 months at $758.50 each; Midvale Steel Co., 1,000 in 24 months at $900 each; and in addition to these four home firms, one foreign firm, Hadfields, Ltd., proposed to deliver 3,000 shells in 16 months at $513 each. For the 14-inch projectiles, the proposals were as follows: Crucible Steel Co., 2,000 in 42 months at $543.50; Midvale Steel Co., 5,600 in 30 months at $550; Washington Steel & Ordnance Co., 1,000 in 22 months at $500 each; Hadfields, Ltd., 4,500 in 19 months at $356 each. From these figures it will be seen that Hadfields, Ltd., offered to build the 16-inch projectiles at from $237 to $387 less per shell and that in the case of the 14-inch projectiles the prices were from $144 to $194 less per shell. The time for delivery (a most important consideration, in view of the fact that our present Navy Bill is an emergency measure) was in some cases as much as 23 months less.

This question of time and cost is, of course, very important; but far more so is the question of quality, and with regard to this, the facts made public by Mr. Daniels are surprising and certainly disconcerting. He tells us that out of thirty-four 14-inch shells submitted by the Bethlehem Steel Co. for test, only three passed, which gives a percentage of 8.8. Of the test shells submitted by the Crucible Steel Co. 37.7 per cent were passed; while of the samples submitted by the Midvale Co. there were passed 73 per cent. Of the shells submitted by the Hadfields, Ltd., consisting of three sample shells and six additional test shells, not a single one failed to meet all the requirements—a record of 100 per cent.

"In view of this record," the Secretary tells us, "and of the necessity of having our ammunition equal to that of other countries, I felt that I would have been criminally negligent, even if no question of prices were involved, in refusing to accept the bid of the Hadfields. I am determined that our Navy shall have as good ammunition as any other nation, and, if possible, better ammunition, and will buy such ammunition at any time and any place that it can be best obtained."

As we have said, we regard the Secretary's position in this matter to be unassailable. Had the award been made to this foreign company on the ground merely of less time and lower cost, our manufacturers would have had some cause for grievance; for they are obliged, in all Government contracts of this character, to work under the eight-hour law; whereas the foreign competitor is not restricted and may work as many shifts as he pleases. Furthermore, the notoriously higher wages paid in this country constitute a heavy handicap in any competition with foreign munition makers. For this reason we believe that if in competitive bidding for shells, or indeed for any naval material, our manufacturer can equal the foreign maker in the quality of the product, he should secure the contract, even though within reasonable limits he should exceed the foreign bid in the matter of cost and time for delivery.

Speaking broadly, it is advisable, in the construction of ships, guns, armor, ordnance and all the material of war, that this country should be absolutely self-contained; for if we depended upon some foreign country for the supply of certain special material, such, for instance, as these armor-piercing projectiles, it is conceivable that we might, some day, find ourselves at war with that very country. The moral of the whole situation, then, is that our Ordnance Bureau and the shell manufacturers should get together in the effort to bring American-made projectiles up to the 100 per cent efficiency shown by these Hadfield shells; for, as the Secretary truly says, our Navy should have as good ammunition as any other nation, and if possible, better.

Is Government Ownership of Wireless Intended?

THE new legislation for the regulation of radio communication and apparently designed for Government ownership and control has been vigorously pushed forward by the Navy. At the present writing the Bill is in the hands of the Committee on the Merchant Marine and Fisheries, Hon. J. W. Alexander, Chairman.

To all intents the Secretary of the Navy is urging the control of radio communication by the Government as a matter of National defense and as making for efficiency in naval, military and commercial work. "The Bill," says Secretary Daniels in defining the attitude of the Navy Department, "covers the purchase of coastal stations only, that is, only those used to communicate with ships, and, by permitting the Navy Department to open all of its stations to commercial business, discourages the extension of any existing commercial systems or the organization of new systems. The Department strongly recommends that the committee provide for the purchase of all stations used for commercial purposes. In some cases the status of existing stations is constantly changing, and decisive action at this time will result in a saving of public funds. I recommend that Section 6 of the Bill provide for the purchase, through the Navy Department, of all existing coastal and commercial stations in the United States, Alaska, Hawaii, Porto Rico and the Swan Islands within two years at reasonable valuation, and that no license be granted after two years from the date of the passage of the Bill."

In recommending the passage of the Bill the Navy Department has laid great stress on what it considers the unsatisfactory state of affairs in the wireless field to-day. It is convinced that only by the Government operation and control of all stations used for commercial purposes, other than those on board merchant ships, can mutual interference and other troublesome features be eliminated. And that the Navy is now operating some fifty odd stations is offered as proof of its ability to handle successfully the entire radio telegraph business of the country.

As would naturally be expected this story has another side—that of the commercial companies. The wireless interests in the United States see the Bill in the light of an opening wedge in a campaign obviously designed for eventual Government ownership of all communication lines in the country. They point to the fact that it is the commercial stations that have played the greatest rôle in the development of radio telegraphy. As for the preparedness aspect of the Bill the companies mention that they have voluntarily placed their highly developed equipment and skilled operating staff at the disposal of the Nation, in time of peril. At any rate, the example of Great Britain is considered ample proof that commercial interests can coöperate with the Government forces in time of war in an advantageous manner: the most important wireless work of the British nation is now being handled through private stations, despite the fact that there are plenty of government stations available. Then again, the private stations in this country—those intended for inter-continental service—are at present operating with other stations in England and in Germany, owned by the same or allied interests. In the event of our Government taking over the American stations, how would it make arrangements with the stations in foreign lands? Would this invaluable trans-Atlantic—and trans-Pacific—business be cancelled?

As impartial observers, favoring neither one side nor the other, we are of the opinion that the commercial interests are in the right. Admitting that in most of the countries of the world the wireless stations are government-controlled, the fact remains that this is rather a late day for the Navy suddenly to arrive at the conclusion that it must control the commercial stations on American territory. The privately owned stations in America have given us every reason to believe that they have a perfect right to continue as in the past. If the Navy has fault to find with the interference and other difficulties arising under present conditions, it has only itself to blame. The Federal regulations were formulated to eliminate just those difficulties. If they are properly enforced their mission should be realized.

A Timely "Don't" for the Motorist

A RECENT news item leads us to point out, to those of our readers who own cars, a danger which the experience of life insurance men has shown to be a real one. We refer to the practice of running the engine in the garage.

One owner may pride himself upon the fact that he can, and does, periodically give his car a thorough overhauling and testing out. Another is enough of a practical mechanic to have rigged up a lathe or drill or cutter in his garage, to be run from the car. Perhaps another is a farmer, and has found it easier to bring the churning to the garage than to take the engine to the milk house. In any of these or a thousand other connections one may have developed the habit of running the engine in the garage; and during the present weather, if this is done at all, it will be done in a closed garage.

This innocent appearing custom may easily lead to a fatality—not, as one might expect to read, from explosion, but from a far more insidious cause. Incomplete combustion of gasoline is attended by formation of carbon monoxide. The only way to avoid this is to secure perfect combustion of every last atom of fuel; and every motorist knows that this is always difficult, and often impossible.

Now, carbon monoxide is a deadly poison. Air containing more than one part of this gas in 1,000 is dangerous and the breathing of air whose carbon monoxide content exceeds one part in 500 means rapid coma and death. It is a treacherous gas, too. Tasteless, odorless and colorless, it reveals its presence to none of the senses, but only by its effects. And these appear, not gradually, but in the form of such sudden and violent dizziness that unconsciousness follows at once, almost as from a blow. Before the victim can know his danger he is lying senseless on the floor; a few moments in the atmosphere of constantly increasing poison content, and he is beyond all help.

The most experienced chauffeurs as well as motor dilettantes have lost their lives in this manner. So if the engine must be run in the garage, the latter should be left thoroughly open to all outdoors. An engine running normally, even with doors and windows ajar, may generate carbon monoxide fast enough to outstrip the circulation from this limited ventilation. But a much better plan, and a wholly safe one, is to take the engine outdoors for anything beyond the very briefest test or use. There, any carbon monoxide given off, being lighter than air, will be dispersed to a height at which it will endanger no one.

Use of Molybdenum in Alloy Steels

AN investigation to ascertain why molybdenum as a possible source of economic wealth in this country should remain undeveloped has been made by the United States Bureau of Mines, and a report on the facts obtained has been published. A preliminary review of the situation showed that the market for molybdenum in alloy steels must be developed or that new uses for the metal must be created before the demand would be sufficient to warrant any extensive mining of the ore.

One of the chief factors in retarding the development of any demand for molybdenum by the alloy-steel trade was that manufacturers who might use or might investigate the possibilities of using the metal were kept out of the market by the fear of not being able to obtain steady supplies. On the other hand, those who might be interested in the development of some of the extensive low-grade molybdenite or wulfenite deposits in this country were prevented from doing so by the small visible demand and the fear that any large production would glut the market. Owing to these conditions the mining of molybdenum has in the past been confined almost entirely to small-scale operations on high-grade streaks of molybdenite ore, and the methods of recovery have been limited largely to cobbing and hand picking.

[Feeding Value of the Peanut

RESEARCHES by the U. S. Bureau of Chemistry show that the peanut and two globulins which have been separated from it contain an abundance of diamine nitrogen, a substance which is indispensable to the nutrition of animals and is contained in inadequate amounts in the common cereals from which most feeds are derived. Peanut press cake should, therefore, prove to be an easily accessible material with which to make such cereal feeds more efficient.

Aeronautical Notes

A Queer Accident.—On December 28th, states the *Handelsblad*, a German aeroplane was obliged to descend at Nymegen, owing to motor trouble. The machine crashed onto the roof of a house, and the two occupants, one of whom was an officer wearing the Iron Cross of the first class, were injured. The German aviators were taken by soldiers to the officer commanding the local Dutch garrison.

Flying Field for War Department.—It is reported that the War Department has purchased about seven hundred acres of land on lower Chesapeake Bay near Fort Monroe for an aviation field. The sum of $290,000 was paid for the land, this money having been appropriated by Congress at the last session. Officials estimate that $1,500,000 will be asked of Congress for buildings and equipment to make it one of the foremost stations of its kind in the world.

Another Super-Zeppelin.—If the *Thurgauer Zeitung* is to be credited a new super-Zeppelin has recently been tried over Lake Constance. Observers on the Swiss shore report that the airship has four gondolas, under the foremost of which was suspended a small car apparently intended to be lowered for observation purposes. It is stated that a defensive armament is installed in chambers built in the sides of the envelope, and that at the stern of the vessel was suspended an aeroplane which, on being released, flew away inland.

Testing of Giant Searchlight.—The 1,500,000 candlepower searchlight recently installed on the flying field at Hempstead, Long Island, is soon to be tested in order to determine its value in detecting aircraft at night. It is planned to have aviators go up in biplanes, followed by others who are to represent the enemy, whereupon the searchlight will find each hostile machine and keep it illuminated while the other planes, hidden by darkness, will attack and destroy it. It is also planned to have the defenders' planes drop various colored lights as a guide to those on the ground in locating the intended prey. The searchlight has a range of four miles.

Aviation in the Coast Guard.—The last annual report of the Coast Guard recommends the use of aeroplanes in connection with the life-saving work of the service. When a shipwreck occurs too far from the shore to be reached with the line-throwing gun, and when the state of the sea makes it impossible to use lifeboats, it is believed that a line could be carried to the wreck by means of an aeroplane. Apart from their use in life-saving, aeroplanes would be extremely serviceable in the work of locating derelicts. Congress has been asked to provide aviation stations and equipment for the coast guard, and in the expectation that such work will be taken up sooner or later the guard has already assigned three junior officers to undergo training at naval and private aviation schools. An additional argument in favor of this plan is the fact that the aviation facilities provided for the Coast Guard would be a valuable supplement to naval aviation equipment in case of war.

Giant Air Yacht Wrecked by Gale.—On December 22d, at the height of a gale which raged in New York and the vicinity, the great flying yacht recently described in the columns of this journal was totally wrecked. According to the *Aerial Age Weekly* the hydroaeroplane was on the shore near the hangar at Port Washington, Long Island, which was in process of construction. The craft was held down with ropes in a manner deemed safe by the mechanics. First the 75-mile per hour gale caught the new hangar, which was torn loose from its foundation and sent end over end inland, where it finally broke to pieces. Then came the turn of the air yacht, which broke loose from its moorings, rose in the air, and came down with a crash. The mechanics tried to catch the dragging ropes, but before they could reach them the wind turned the machine over and over, and practically tore it apart. In less than three minutes the flying boat was reduced to a shapeless mass.

How German Aircraft Land at Night.—The one great problem of the aeroplane pilot, namely, making a safe landing at night, appears to have been solved by the Germans in an ingenious manner. A large white light is placed in the center of the aerodrome, sunk in a pit in the ground and covered over with a sheet of thick glass to withstand the weight of an aeroplane should the wheels pass over it. At a distance of about 250 feet from this light, and also sunk in the ground, are four red lights corresponding to the cardinal points of the compass. Each of the red lights is connected by subterranean cables to a wind vane, mounted on a mast or tower at some convenient point. At night the central light glows constantly, while the red light in the direction of the wind that happens to be blowing also shows, indicating to the pilot the wind conditions where the landing is to be made. It is understood that a system of altering the lights has been devised, so that an aviator has to understand the code in order to know his whereabouts. Thus enemy airmen are thwarted from making use of the lights as guides.

Science

Molybdenum in the United States.—The United States Bureau of Mines has published a report on the extent of the deposits of molybdenum ores in this country, and on the best methods of turning this undeveloped national asset to account. The report aims to show that the element is commoner than has been generally supposed, and that large supplies are obtainable from deposits of low-grade ore in the United States; also that there is a latent market for the metal in the alloy steel trade, needing only the assurance of a steady supply from the miner for a steady development.

A Meteorological Service in Turkey.—The Ministry of Instruction of the Ottoman Empire has entrusted Dr. Obst, professor of geography at the University of Stamboul, with the task of organizing a national climatological and meteorological service. It is proposed to publish a climatological yearbook and to make daily weather forecasts. The organization of this service in a country where hardly any meteorological work has heretofore been done is, however, dependent upon the peculiar condition that funds must be raised from private sources for the initial expenses, after which the running expenses will be met by the Ottoman government.

Development of the Wire Drag.—The last annual report of the Coast and Geodetic Survey emphasizes the increasing use and value of the wire drag in hydrographic surveys. During the past fiscal year a drag 15,000 feet in length was used in open areas, as compared with the previous maximum length of 12,000 feet. The General Board of the Navy has given consideration to the use of wire-drag surveys as a part of the national defense, and the Navy Department has requested that the areas covered by such surveys be indicated on special editions of the Coast Survey charts for the use of naval vessels.

"Mushy" halibut, one of the most serious handicaps upon the halibut fishery of the northwest coast, has been the subject of recent investigations by the United States Bureau of Fisheries. The trouble is first noted in the early summer, and increases in prevalence on certain grounds until the unmarketable fish form so large a proportion of the catch as to compel the abandonment of the fishery or removal to less accessible grounds. A specialist of the Bureau has discovered that the "mushy" condition is caused by a minute protozoan parasite, which multiplies abundantly and brings about a degeneration of the muscle tissue. The subject is still under investigation, with a view to devising remedial measures.

High-Frequency Vibrations in Air.—A new field for investigation suggested by Col. G. O. Squier relates to high-frequency vibrations in air, with possible applications as a means of communication. At present we do not know of the existence of vibrations in air much exceeding 40,000 to 60,000 cycles per second, but far more rapid vibrations may occur in nature, though they are beyond the limit of perception by the human senses. Col. Squier remarks that electromagnetic waves of high frequency existed through all time unperceived until Hertz devised a "detector." He suggests that efforts be made to devise a detector for air vibrations capable of revealing their presence or absence up to 500,000 or a million per second.

Marine Biological Laboratory at Key West.—The United States Bureau of Fisheries reports that funds are now available and plans have been drawn for its long-needed biological laboratory at Key West. The site is near a base of supplies, is accessible by water and rail, and is in a region of important commercial fisheries. Situated far from the influence of fresh-water rivers and on the thoroughfare from the Gulf of Mexico to the ocean, it should be eminently suited to the study of marine forms of life. Some of the projects it will undertake are the study of the artificial propagation of the green turtle, the investigation of the spiny lobster and the stone crab, the fostering of the struggling industry of sponge culture, and the study of the important food fishes of the Gulf of Mexico and the Straits of Florida.

American Bird Reservations.—At the seventh annual meeting of the Conservation Commission of Canada, Dr. T. Gilbert Pearson called attention to the remarkable progress made in the establishment of bird reservations in the United States, under the auspices of the National Association of Audubon Societies. There are now seventy reservations, distributed over the country from the gull and tern refuges on the coast of Maine to the egret asylums in Florida. A line of these reservations extends along the great migratory route of the Mississippi. A reservation larger than the state of Connecticut has been established in the Yukon delta of Alaska. There is a famous reservation in the Hawaiian Islands, and one has been recently established in the Canal Zone. There is great need for reservations in British America, and a particularly important site for such refuges is Labrador, where a deplorable waste of bird life has long been in progress.

Industrial Efficiency

Inverted Hammers have been successfully employed in the removal of the cofferdam for New York city's Forty-sixth Street pier. Here many 72-foot piles came out with a direct pull of 40 tons, and, according to good authority, it is doubtful if any but the key piles required more than the equivalent of 100 tons. All of which proves that inverted hammers can be used to pull the longest steel sheet piling if it has been properly driven.

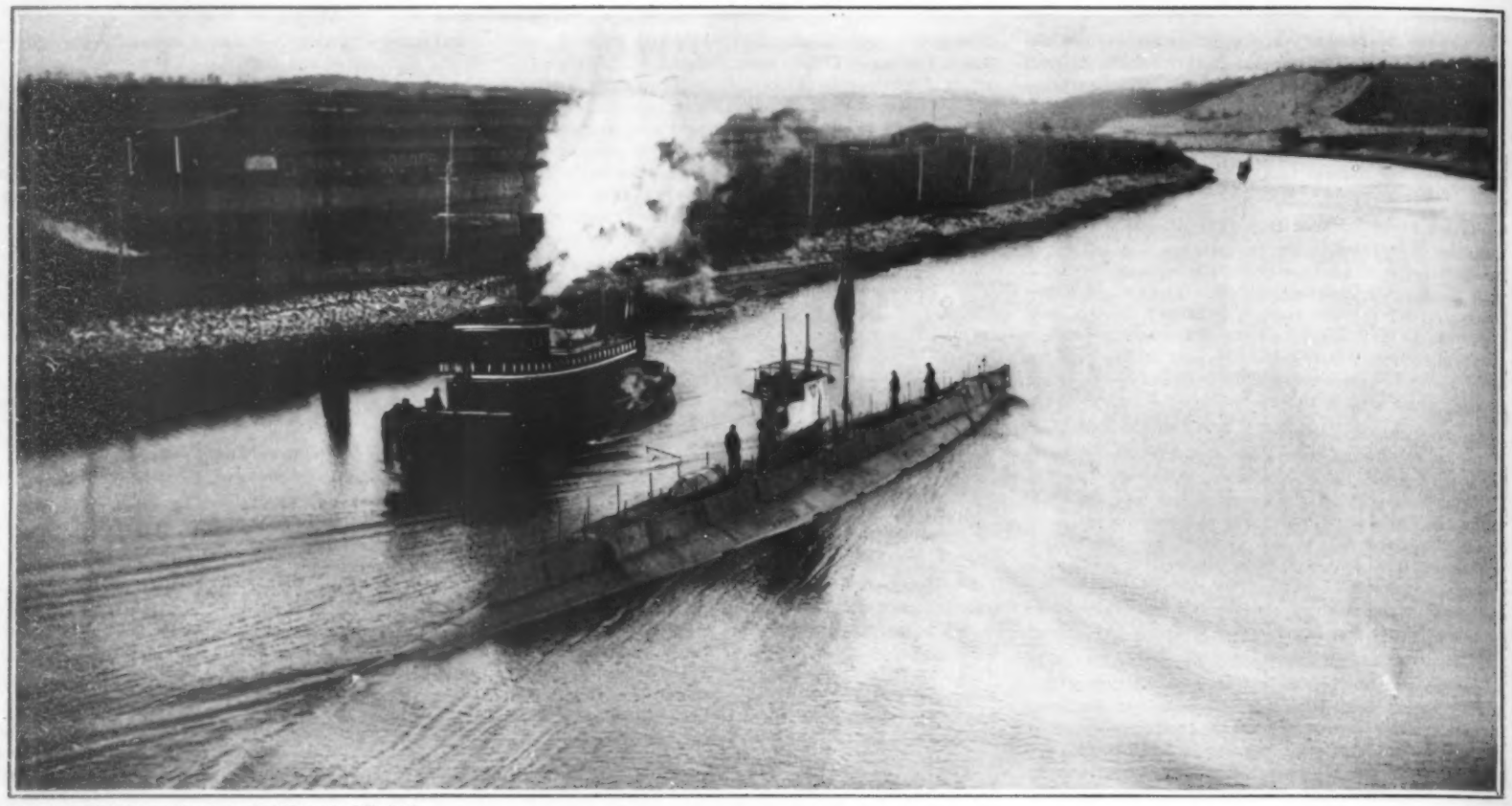
Workmen's Compensation Legislation.—The Pennsylvania Compensation Board in a recent decision made the following ruling: An employee injured on the premises occupied by or under the control of the employer during the lunch hour or when on his way home or at any other time or place when not actually engaged in furthering the employer's business or affairs is not entitled to compensation unless the accident was caused by the condition of the premises or the operation of the employer's business.

Industrial Lighting by Electricity.—Unsatisfactory illumination, it was recently pointed out by F. H. Taylor in a paper on this subject read before the Junior Institution of Engineers in England, results in (1) an increase in the number of accidents, (2) possible damage to eyesight and health, (3) diminished output of work, and (4) imperfect discipline. Reference was made to the recommendations contained in the report on lighting in factories and workshops issued by the Home Office Departmental Committee in 1915, and attention was drawn to the importance of proper facilities for switching control of the lights.

Germany's Measures to Save Her Tin.—Because of the stoppage of tin imports, Germany is reported to have prohibited the use of solder containing more than thirty per cent of tin, and the tin so used must have been recovered from dross or scrap. The making of soldered joints has to be restricted to cases where lapping, riveting and electric or autogeneous welding are impracticable. It is stated in the *Iron Age* that a usable solder can be prepared from ten parts of tin, 80 of lead and ten of cadmium. Although cadmium is three times as expensive as tin, this is considered of no consequence because of the necessity of using tin for other purposes.

New Method of Soling Boots.—The attention of the Leeds (England) consulate has been called to a recently patented method of manufacturing boot soles from scrap leather. It is claimed that the soles are nonsuction, nonslipping and waterproof, and can be produced at a much lower cost than the ordinary leather sole. Owners of plants for heel building, it is believed, will find themselves in a position to adopt conveniently the new process. It is also claimed that the novelty of the patent may be enhanced by an ingenious arrangement of strips of rubber attached to a thin layer of canvas, the rubber strips fitting into the interstices of the leather sections. This is said to give a pleasing resiliency to the step of the wearer and to do away with the aching of the feet sometimes produced by purely rubber soles.

The Development of the Rittman Process.—One of the notable features in the current general expansion of American chemical industries is the evolution of the Rittman process for transforming a large proportion of the residues of our petroleum refineries into gasoline, benzine and toluene. The process, originated in the Bureau of Mines and elaborated as an industrial method under the auspices of the same bureau, has now issued from the experimental stage and taken its position as a recognized industrial asset in the Nation's cycle of productive activity. By its aid vast quantities of petroleum waste, hitherto available for little byond fuel purposes, can be transformed at will either into gasoline for use in motor engines or into benzine and toluene, also susceptible of the same utilization but constituting likewise the crude material for the manufacture of the two coal-tar high explosives—picric acid and trinitrotoluene—and forming also the starting points for the synthesis of an almost endless variety of dyestuffs, medicinals, photographic chemicals, artificial flavors, and perfumes. Under normal conditions in times of peace the by-products of our coke ovens will more than meet the Nation's demands in the manufacture of the latter categories of chemicals. The case is, however, far different in regard to the supply of motor fuel for automobiles, aeroplanes, and motor craft. Apprehension is felt that at an early date the supply of gasoline from crude petroleum, or of benzine and toluene from the distillation of coal, may fall behind the world's demand for motor fuel. The Rittman process promises to relieve entirely this anxiety, or at least pospone all danger of a shortage to a very distant date. Economically it will act as a healthful check upon any unnatural tendency to increase the price of ordinary gasoline. The process as now perfected makes it possible to produce gasoline at a cost of 6 cents per gallon. This figure may be contrasted with the current wholesale rate of 22 cents per gallon for gasoline obtained directly from petroleum refineries.



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The "Isaac Peral," the American-built Spanish submarine, passing through the Cape Cod Canal. Note the lifeboat on her deck

American-Built Submarine for Spain

The 800-Ton "Isaac Peral" Which Represents the Latest Development of the Art

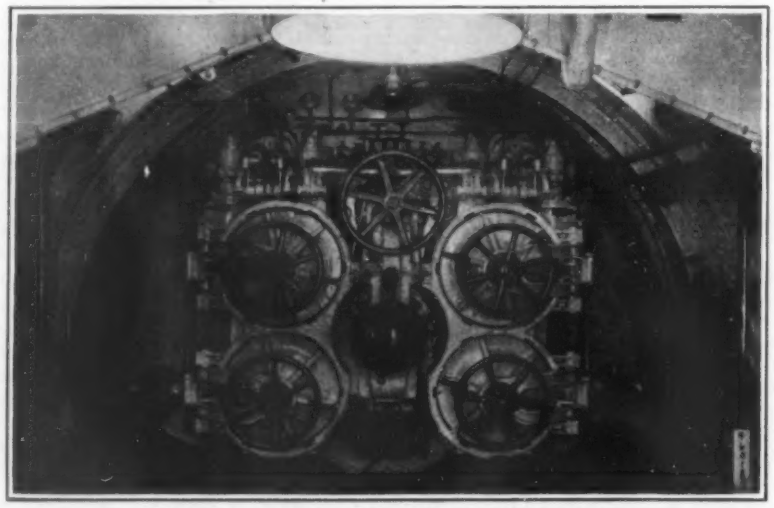
THERE has recently been completed at Quincy, Mass., by the Electric Boat Company, a submarine, the "Isaac Peral," which represents the latest development of the art of submarine building in the United States.

The vessel is about two hundred feet in length, and the company states that in her size and dimensions she may be compared to the German submarine "U-53," which very suggestively put into Newport last summer before starting out to raid shipping off our coast. The company claims that she is entitled to be reckoned as of the 800-ton type, although it seems to us that she is scarcely large enough to fulfill the requirements which the experts of our Navy Department consider to be indispensable in a sea-going submarine of 800 or 900 tons displacement.

The speed of the vessel is 15 knots when running under her oil engines at the surface and 10½ knots when using her motors in the submerged condition. On the surface her radius of action is stated to be over five thousand sea-miles, and submerged she can travel 100 miles without coming to the surface.

For running on the surface and for charging her batteries, the "Peral" is equipped with two 600-horse-power Diesel engines, which were built at the Groton plant of the Electric Boat Company. According to the company, the submarine freighter "Deutschland" has a total horse-power of only 900, therefore the "Peral" has a very considerable margin of speed over the German boat.

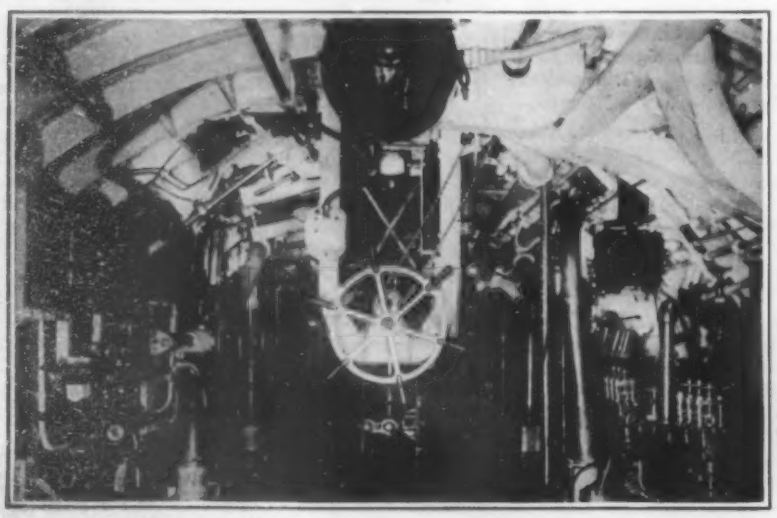
The armament of the boat consists of four torpedo tubes mounted in the bow, and she also carries a 3-inch rapid-fire gun, which is so mounted that it can be used not only against surface craft, but can be elevated to repel aircraft attacks. This gun is placed immediately in front of the conning tower.



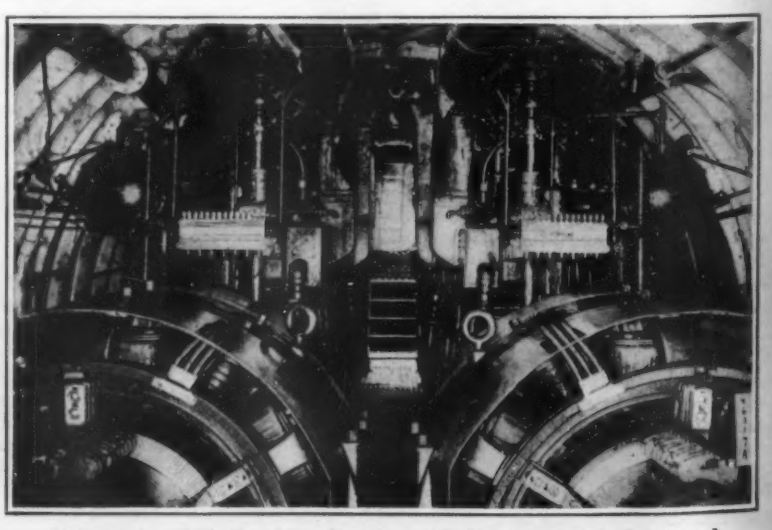
Torpedo tubes of the "Isaac Peral," and the firing mechanism

Aft of the torpedo compartment is that devoted to the officers. In order to keep it dry and prevent sweating it is cork-lined, and experience while cruising in the present wintry weather has shown that these quarters are warm and comfortable. Aft of the officers' quarters is the operating compartment, which, of course, is situated about amidships and immediately below the conning tower. Here are to be seen the dials, indicators, gages and the various wheels and levers used in controlling the boat. It is steered electrically through a comparatively small lever, which for size may be compared with the throttle on the steering wheel of an automobile. The crew sleep on bunks which fold back into the sides of the boat when they are not in use. Cooking is done on an electric stove, and all the arrangements having to do with the life and comfort of the crew have been studied with great care and have been made as compact as possible in order to prevent over-crowding and to provide as much space as possible for the movements of the officers and crew.

The "Isaac Peral" has been built in a little over twelve months' time, the hull being built at Quincy and the engines at the Groton Works.

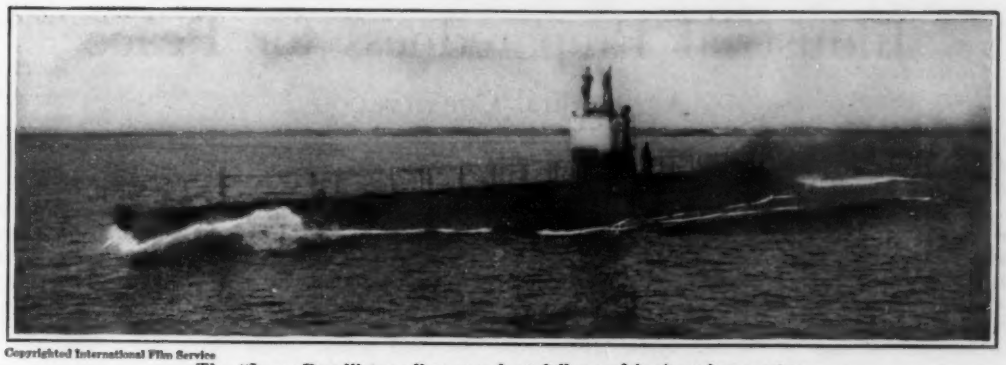


The navigating room of the "Peral," with its array of controls



Engine room of the Spanish submarine, with the generators in foreground

It is of historical interest to note that the "Peral" takes her name after a Spanish naval officer who completed the first practical submarine for Spain in 1887. For this Lieut. Peral received a title and the gift of $100,000. Just how great has been the advance in the last thirty years is shown when we remember that Lieut. Peral's first boat was only 70 feet long, 8 feet 6 inches in beam and had a displacement of 87 tons. Her horse-power was only 60. She carried but one torpedo tube and, of course had no guns.



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The "Isaac Peral" traveling awash at full speed in American waters

Before very long the "Peral" will start unattended for her voyage across the Atlantic Ocean. The company who built her draw attention to the fact that in July 1915, ten boats of smaller tonnage than the "Peral," but of the same general type, made the voyage successfully.

A Portable Disinfector

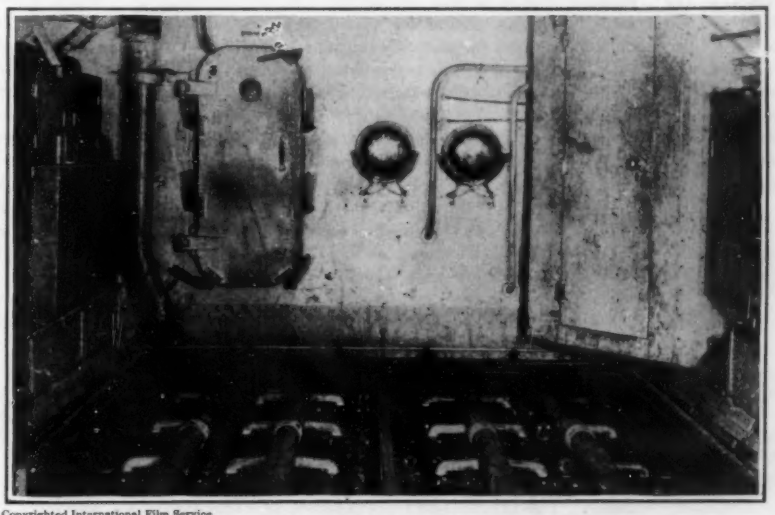
PREPAREDNESS consists of an adequate supply of other things than munitions of war, battleships and trained men, and our Government has recognized one of these further needs by providing for the safety of our troops against a foe more deadly than hostile bullets. The diseases which sweep away soldiers by tens of thousands, the dread typhus, cholera and plague, are to be resisted among our forces by a scientifically planned device for disinfecting uniforms and other equipment and thus preventing disease or checking its spread.

Six portable disinfectors were sent to the Mexican border in October to be used by our forces, and as they represent the latest development in sanitary preparedness, our boys are well protected. The machines will thoroughly disinfect fifty uniforms and other articles of the soldiers' equipment in one operation, doing the work in forty minutes and returning the garments to their wearers dry and ready for immediate wear, without the least injurious effect upon the material.

The disinfecting is accomplished by steam under pressure, by formaldehyde gas, or by both. The cost is nominal, while the operation is so simple that the average non-commissioned officer could master the details readily.

The device is the invention of a New York physician. It consists of a 5-horse-power vertical boiler for generating steam, a disinfecting chamber with rack upon which clothes may be hung, a tank for formaldehyde and ammonia, a water tank with injector to the boiler, a fuel box and a feed box. The whole is mounted on wheels and forms a vehicle which may be drawn by four horses or trailed by a military tractor. It has a weight of 6,500 pounds, is 16 feet long and about four feet wide. The machines cost about two thou-thousand five hundred dollars each.

The disinfectors are designed to follow the troops or to take a position back of the trenches in time of war, and at regular intervals the soldiers can receive the benefit of a thorough purification of their effects. In case a regiment were exposed to typhus, a disease carried by vermin, the spread of the scourge could be effectually checked by this process: The men would enter disrobing tents set up about the disinfector where they would strip and be shaved and scrubbed with soap and water, and antiseptic. Meanwhile their uniforms and personal effects would receive treatment in Dr. Watter's device. The garments are handled in this manner: a sliding carriage on tracks is drawn out of the disinfecting chamber and the clothes are hung upon hooks within the rack, each uniform bearing a metal tag. Smaller personal effects are laid in the bottom of the rack and it is then pushed into the chamber. It is closed by a radial locking door, swung on a davit. When the door is shut a vacuum is drawn to insure complete penetration. The disinfecting chamber is double jacketed, and steam is first allowed to enter the outer jacket and is then driven into the chamber at 15 pounds pressure. Because of the vacuum previously drawn,



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Arrangement of the storage battery in the "Isaac Peral"

every particle of the fabric is penetrated by the dry steam and this process continues for twenty minutes. Then vacuum is drawn again, after which hot, sterile air is drawn through the garments, so that in a few minutes they are ready to be taken out warm and dry and ready for the immediate use of the fifty soldiers, who have meanwhile been shaved, scrubbed and rubbed dry.

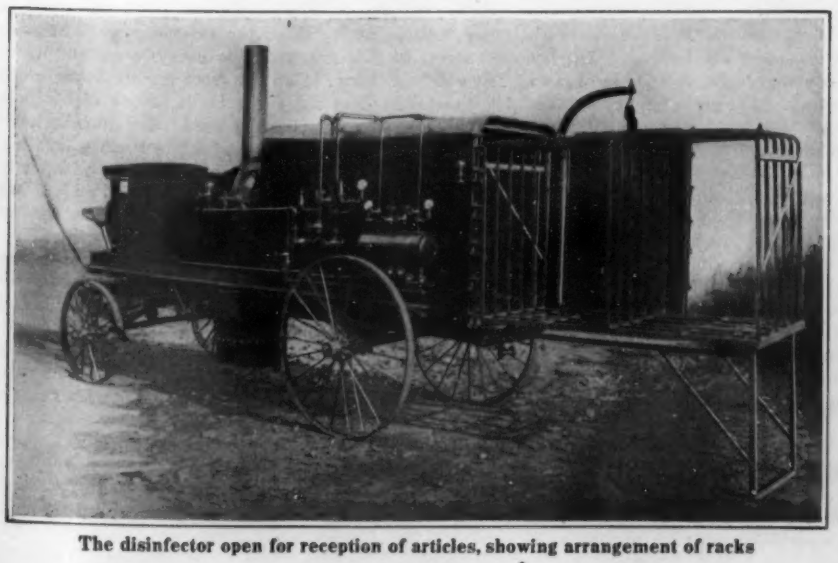
Mattresses and bedding are handled in a similar manner, while articles which might be injured by steam are treated with formaldehyde. This enters from a tank alongside the chamber in the form of gas, and before the objects are removed they are treated with ammonia gas which neutralizes the formaldehyde, so that the articles are deodorized. The disinfecting chamber gives ample space for mattresses and other bulky articles.

The efficacy of this system has been demonstrated by non-portable disinfectors operating on the same principle. They are in use at quarantine stations, ports of entry, municipal lodging houses and jails, where, in a lesser degree, the same conditions of filth and vermin are found as in the trenches. By the invention of a portable device of this nature, our boys on the border have been armed with a protection against disease, and a means of defense has been afforded for the frontier population against infection carried by refugees from Mexico. Typhus, a disease that flourishes in filth, is one for which no serum or other effective preventive has been discovered as yet. It can be checked only by cleanliness of body, and the garments of those who have been exposed to it be burned or disinfected. This device does the work at a minimum of expense, the main outlay being for fuel, which may be wood, coal or coke.

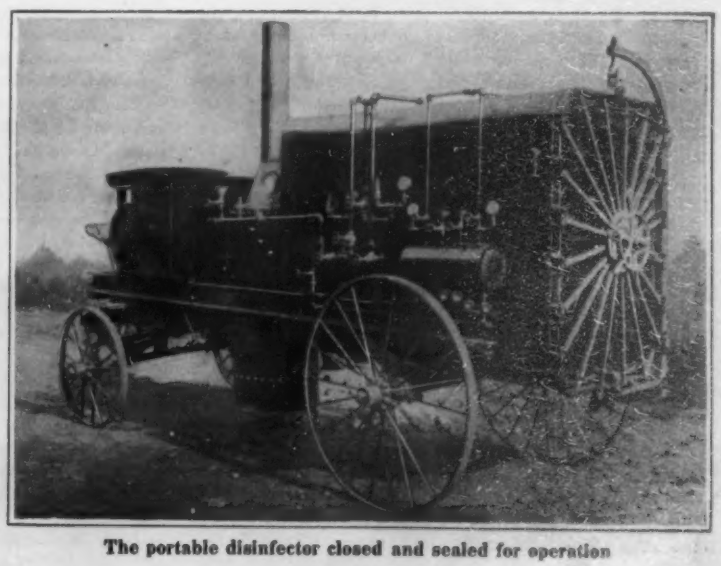
Twenty-one of these portable disinfectors were sent to Serbia in July, 1915, but they were captured by the Germans before the unfortunate Serbs could profit by them. They were badly needed by that nation, as it was estimated that no less than 60,000 Serbs were slain by typhus in the period between the out-break of the war and July, 1915. It is clear that a device which can prevent such losses is as valuable to an army as shells and guns. It seems hardly necessary to state here that no one has appreciated the importance of disinfectors in army equipment more than the Germans. It is particularly in their Serbian and Russian campaigns that the Teutons have made the most extensive use of disinfectors.

New Studies of Fog

THE recently published report of the 1915 ice patrol of the "Seneca" contains a description of some novel and important investigations of fog, made by Messrs. Wells and Thuras, who were detailed to the "Seneca" by the United States Bureau of Standards. By means of the well-known "corona" method of Barus, the nucleation of the air was measured three times a day, whether fog was present or not. By "nucleation" is meant the number of ultra-microscopic nuclei, on which condensation occurs in the atmosphere, present in each cubic centimeter of space. The nucleation at sea was remarkably low and uniform—viz., from 500 to 3,000—as compared with about 150,000 in port. On certain days, however, it rose to 50,000, which is believed to be the nucleation at the surface of the sea in cyclonic areas; nuclei probably being produced as salt particles by the evaporation of spray from waves. A matter of more popular interest is the quantity of liquid water present in fog. This was found to be very minute; viz., less than a gram per cubic meter. A block of dense fog 3 feet wide, 6 feet high and 100 feet long contains less than one-seventh of a glass of water, which is distributed among 60,000,000,000 drops. During the densest fog of the voyage the diameter of fog particles was found to be 10 microns; just about the limit of visibility with the naked eye. The fogs over the Labrador current are probably low lying, so that it should generally be possible for an observer at the masthead of a ship to see a flag or powerful light at the masthead of another. A detailed report on these investigations is to be published as a scientific paper of the Bureau of Standards.



The disinfector open for reception of articles, showing arrangement of racks



The portable disinfector closed and sealed for operation

Industrial Preparedness for Peace

Agricultural Conservation

By E. E. Miller

WE are a wasteful people. The charge has been made many times and there seems to be no escaping it. Not only are we wasteful in our individual expenditures and habits, but many of our commercial and financial processes are such as no other equally enlightened people would endure.

Our chief fault seems to be the wanton waste of material. One who looks at the lack of utilization of products and by-products of mine, farm and factory must be impressed with the fact that we have yet much to learn. The efficiency of the great packing houses in converting "everything about the hog except his squeal" into something useful has been a national boast; but in many cases the admiration of this efficiency seems to have provoked no desire to emulate it.

That this country should have to buy abroad dyestuffs, drugs or explosives made from the coal-tar bases which we could produce at home in vast quantities is little credit either to American ingenuity or American enterprise. That we have imported nitrogen to fertilize our fields while wasting the sulphate of ammonia from tens of thousands of coke ovens is not much evidence of business efficiency. It was impractical to utilize our alunite beds or kelp fields in competition with German potash salts; but that does not palliate the state of affairs revealed when the Bureau of Mines estimates that the cement manufacturers of the country are letting 100,000 tons of potash go to waste each year in the dust from their plants. One company in California utilized this waste last year and secured a profit of $80,000 from the potash, besides escaping the damages it had formerly been called upon to pay to adjacent land owners.

Copper smelting companies continue to deaden vegetation for miles about their plants and to fight endless damage suits in preference to converting the waste from their smokestacks into a marketable by-product. And the reckless waste of timber from forest to factory is an old story; despite many improvements in methods, it still goes on.

But it is by waste of the products of the farm that the average American citizen—the helpless "consumer"—is most vitally affected. There is every year produced and permitted to go to waste an incredible amount of farm produce which is really needed by the country. Many are the examples which might be given; we have space to cite but a few.

At least one-third of the feeding value of the corn crop is in the stalks. A great part of this is absolutely unutilized. In many cases no attempt is made to get anything out of it. In other cases it is utilized—to no profit. The Southern farmer who "pulls fodder" gets some good feed, but he takes as much off the value of his corn crop as he gets out of his roughages. So he has had his labor for nothing. Thousands of farmers who have tried cutting their corn and shredding or cutting up the stalks after the ears are pulled have given it up after a few years as an unprofitable practice. Of course, other thousands of farmers find it profitable to do this. The point is, that here is a farm product, or by-product, worth hundreds of millions of dollars which is in large part wasted because generally profitable means of handling it have not yet been devised. There are comparatively few farmers who could not feed their cornstalks to advantage if they had machinery that would convert them cheaply and rapidly into forms that could be stored and fed as easily as hay. The corn harvester and the shredder do good work, but many a farmer finds that it costs him more to handle his corn with them than the fodder is worth. There is work to be done right here along the lines of both farm machinery and farm management.

Nor is the waste confined to by-products. Every year in which there is a full crop of peaches or strawberries sees thousands of bushels go to waste. Yet every peach or berry is capable of being converted into a foodstuff for which someone would be glad to pay a reasonable price. Canning factories, evaporating plants and preserving outfits consume some of this fruit, but there remains much to be done before the waste is eliminated. A more direct and less expensive marketing system is needed, as is more technical skill in converting the surplus into useful and profit paying forms. The trouble is not so much that the growers do not know how to make use of their surplus as that they are unable to market it at a profit. There is no economy in spending all a thing is worth to save it. Nor is there any economy in a marketing system that provides no means of cheap distribution to care for low priced surpluses or by-products.

Peaches and strawberries are perishable, but apples under proper conditions will keep for weeks or months. Yet every year a large part of the apple crop goes to waste, even though prices for apples are high in the retail markets. This is primarily due to unscientific marketing methods; there is always an inexcusably wide margin between what the grower gets and what the consumer pays. Then, too, there is always a great quantity of apples of inferior quality which could be converted into useful by-products, to the relief of the market as well as to the good of the consumer. Apple vinegar and evaporated apples always retail for good prices. Apple jelly, apple butter, apple syrup and a long list of delicious apple products could be made and marketed if the grower knew, in the first place, how to make them at reasonable cost and, in the second place, how to market them to advantage. Efficient methods of converting the low-grade fruit into these things and of delivery into the hands of the consumer are yet to be worked out. The combined costs of making and marketing leave such little profits in many cases that the grower does not make any attempt to save this surplus of inferior fruit.

It is clear from the above examples that the question of getting the last measure of value out of our agricultural products and by-products is merely one of knowledge and the organized application of knowledge. But it is not sufficient for a few members of our academic and bureaucratic institutions of learning to cultivate that degree of familiarity with the chemistry of fruits and vegetables which will enable them to state to just what purposes a given crop may or may not be put. It is not even sufficient to devise means for circulating this knowledge among the growers so that each member of our agricultural machine shall know just what he can make of each of his crops. It is necessary, in addition to this, that thoroughly standardized, fairly simple and commercially profitable methods for the manufacture, from each crop, of each of its possible products, be devised and made public property. It is equally necessary that ways and means be worked out for getting each of these products to the ultimate consumer at a price which will induce him to buy, but yet which will leave a sufficient margin of profit, after deduction of a scientifically minimized marketing expense, to attract the producer into the fold of efficiency and conservation.

This, of course, brings the Department of Agriculture, perhaps, also, the Department of Commerce, into the picture. For while, on the production side, the desired development clearly falls within the province of the former, it seems likely that the latter could deal more effectively with certain aspects of the marketing problem. In many directions, of course, beginnings have been made. The utilization of hemp hurds, of waste resinous woods, of potato culls, of flax straw, have been discussed in numerous bulletins. The canning of vegetables, peaches and tomatoes and the evaporation of apples upon the farm, have been the theme of another series, the teachings of which have met with especial and nation-wide success.

The distributing problem has been attacked in a way which gives much promise of valuable results, as set forth in a previous article in this series (SCIENTIFIC AMERICAN, August 12th, 1916).

And while such items, so far as systematic covering of the entire field is concerned, cannot be regarded other than as beginnings, the experience obtained and the organizations built up, both official and unofficial, should be of the greatest permanent value.

Nor are the opportunities for scientifically directed agricultural conservation confined to the better utilization of existing crops. The development of new sources of vegetable food for man and beast is another investigation of the utmost consequence which falls naturally into a place upon the program.

It is almost superfluous to point out that new crops are being introduced into the country all the time. The soy bean as a crop of any commercial importance belongs to the last quarter of a century. The grain sorghums which are doing so much for the semi-arid West are not much older in popular knowledge and esteem. The Kudzu vine is a recent importation that promises to have a distinct field of usefulness. Pse-tai, udo, roselle and other vegetables unheard of a short time ago are becoming well known, by name at least. Even new varieties of staple crops from other lands every now and then prove to have a wide place of usefulness here. Examples of this are the durum wheats and the Siberian alfalfas. In no way can these possibilities be detected and brought to the attention of our farmers save by deliberate and organized experimentation.

But we need not give lengthy consideration to this point. With the valuable coöperation of our consular force in all parts of the world, the particular side of agricultural conservation involved in the adaptation of immigrant plants to American cultivation is receiving, we believe, its complete share of attention. And indeed, important as such importations are, they yield first place in interest to new crops from another source. In the beginning there were no crops, only weeds. As agriculture developed, first a few and later many of these weeds were turned by man to his own account and transformed into crops. This process has never ceased. Human necessity and human ingenuity have always been lengthening the tale of the plants that may be profitably cultivated, removing names from the list of weeds and writing them into the catalog of crops. Even to-day our farmers are still busy making crops out of weeds. And this finding of uses for plants once considered valueless is a very important item in our agricultural conservation.

There is melilotus, or sweet clover, for example. For a long time there have been a few farmers, chiefly men interested in bees, who have insisted that sweet clover was a valuable plant and well worth a place as a major crop in some sections. Most farmers, however, have insisted that it was only a weed, and often a troublesome weed. Stock would not eat it, it was said, and it would grow on the thinnest land and on banks and bare places where nothing else would hold, there maturing seed to infest other fields.

The select few maintained that any plant that would grow on a bare heap of clay or a steep bank must be worth something, especially if that plant made richer the spot where it grew, as sweet clover did. It came to be seen that the land where this weed grew was wonderfully better because of that growth. Then came the idea that it might be a valuable soil improver. Trials soon showed the correctness of this opinion. Sweet clover is particular about one thing. It will not thrive on land that is poor in lime. But if there is a sufficient quantity of lime in the soil, the land may display a veritable pauperism in other respects and still the melilotus will grow and do well. In the limestone sections it has become the first-aid crop to the most depleted soils. On land so poor in humus and nitrogen that practically no other crop will grow, sweet clover thrives. Being a legume, and an uncommonly vigorous one, it takes it but a few years to store up in the soil sufficient nitrogen and to furnish by its own growth and decay sufficient organic matter to make the land fertile enough for any of the staple crops.

It has become something more than one of the country's leading soil improvers, too. Stock have become educated to its value, just as the farmers did, and have learned to eat it. It is a fine pasture crop; it makes excellent hay; it can be converted into ensilage. Almost as rich in digestible nutrients as the best alfalfa, stock prefer it to most other feeds, once they have acquired a taste for it. So from being thought a pest, or a plant of value only to the beekeeper, sweet clover has come within a very few years to be esteemed as one of the country's leading legumes, and its usefulness seems just beginning.

Lespedeza, or Japan clover, is another legume that has grown in popular favor from its former rank as a mere wild growth, of probably no harm, but very little good, to a recognized leadership among pasture and hay crops. In the lower part of the Mississippi Valley lespedeza hay is quoted on the markets just as regularly as timothy or alfalfa. In that section much more of it is grown and fed than of either of the others. It is good hay, too, not quite so valuable ton for ton as alfalfa, but considerably outranking timothy. It is little grown for hay outside of four or five states; but as a pasture crop its value is recognized all over the South and up into the bluegrass region. Thousands of acres are sown to it every year, a thing unthought of two or three decades ago. Millions of acres are self-sown with it every year, and there is scarcely a farmer in all the great territory over which it grows who does not recognize it as one of his most valuable pasture plants. The good it has done by holding and enriching old fields and waste lands which, but for it, would have washed away or grown up with really harmful weeds, no man can accurately estimate. It has literally been the salvation of hundred of thousands of acres of land all over the Cotton Belt and north of it.

Another crop of the southeastern states, which is fast changing its status is Bermuda grass. There are still farmers—cotton growers, rather—who fear Bermuda and try to keep it down, but the wiser and more thrifty ones are using it and giving it a chance. The man who regards it as a pest is every year becoming less numerous; the man who thinks enough of it to set it out in his fields is all the time increasing in numbers.

Bermuda is really a very valuable pasture grass. Next to blue-grass it is the country's greatest pasture plant. Indeed, an acre of land in the cotton country set in Bermuda grass will furnish more grazing, produce more

(*Concluded on page 135*)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Steamer vs. Gas Car; the Last Word

[In his issue of December 16th, and in connection with the discussion of the relative merits of the gas and steam cars started by Mr. C. E. Prior, the Editor of the Scientific American *carried a series of questions proposed by Mr. F. V. Wilson. A number of correspondents have answered these in part or in full. All of these writers bring out points of interest which the others overlook; but there is so much duplication between their letters that complete publication of all of them seems inadvisable. The Editor has accordingly prepared a composite letter embodying the essential portions of all these communications; and he prints this herewith to close out the present discussion. For this very fair presentation of the steam owner's attitude the Editor is indebted to Messrs. J. D. Nies and Herbert H. Frey of Chicago, Dr. Malcolm Dean Miller of Wollaston, Mass., and several others who have expressed a desire to remain anonymous.]*

To the Editor of the Scientific American:

Mr. Wilson's first question concerns the fuel expense of the two cars. The steamer gives from 10 to 14 miles per gallon of kerosene. Mr. Wilson claims that the gas car makes 32.8 miles per gallon of gasoline; but this is surely an excessive estimate. We know of but two gas cars which claim a mileage greater than 30. A fair summer average for gas cars of moderate size would certainly be no more than 20 miles per gallon, perhaps not so high. In the bad going of winter it falls considerably lower. Under average conditions we would place the mileage per gallon of a 125-inch wheel base gas car at 25 per cent more than that of the steamer.

This leaves the steamer's fuel bill about half that of the gas car. But the steamer has a power plant about three times as powerful as that of the gas car at the average running speed. Combining the two factors, it is clear that for each dollar spent on fuel the steamer places at the driver's disposal six times as much power as does the gas car.

Of course the gas owner can shift to the low gear for greater power at reduced speed. But every time he does this he concedes the claim that the steamer possesses superiority in not doing it. Moreover, he himself will do it only as a last emergency measure; he admits with mortification that he is ever forced to do it; so any effort on his part to derive controversial advantage from his ability to do it is distinctly double-faced.

As a matter of fact, however, even this unfair advantage does not make his showing a creditable one. The tractive effort on high gear of the typical gas car may be put at 425 pounds. Taking the ratio between this and first speed as 3.33 and deducting 20 per cent for friction—less than the usual allowance—the tractive effort on first speed is 425 x 3.33 x 0.8 = 1,133 pounds, as against 1,975 for the steamer with full stroke cut-off and 1,400 to 1,500 with half stroke cut-off.

Mr. Wilson suggests that the rapid acceleration of the steamer is of secondary importance. Now pick-up is not to be confused with speed. A car may possess very ordinary maximum speed, and yet be able to attain that maximum like a flash. This ability is always satisfying to the soul; and there are times when convenience and even safety depend upon it. When you go to town it enables you to take instant advantage of every hole in the traffic. It also makes it possible to extricate the car from the tight place between the trolley and the coal truck or to leap out of the path of the joy-rider. The most careful driver in the world will some day find himself in front of a train or another car on a blind crossing, and here surely Mr. Wilson will not discount the ability to shoot the car ahead.

The difference between the steam car and the gas car under this heading is just that between the athlete and the rheumatic. One should be able to drive as a healthy man walks, as slowly as he pleases, but in full command of his muscles, ready and able to leap backward or forward at an instant's notice. Certainly many accidents would be avoided if at the critical instant the victim's car possessed power in place of paralysis.

Another correspondent has brought out very ably the answer to Mr. Wilson's query as to why the steamer does not go out on the race track and show up the gas car. Let us mention another angle of this situation. How many owners use their cars on the track, and how many on the roads? What proportion of the power that the gas car develops on the track is available on the road? To the average owner, what is the sense of a track performance that can't be duplicated *on the road that he is going to use?* Eliminating racing luck, it is to be supposed that a track race between gas car and steamer would be very much of a nip and tuck affair, and that, if not actually a winner, the gas car's driver could go home with the satisfaction of having held his own. If next day he should meet his antagonist on the road, the latter would leave him as though anchored, because at road speeds of road cars the steamer has the use of several times the power of the gas car.

If, in Mr. Wilson's words, "the average man who drives his car for the pleasure in it, and with a view to preserving his health," finds these requirements fulfilled through the ability of his car to "average 106 miles per hour for three hours," then his choice of a gas car might be justified. But if he cares for the quality of the ride he is going to get, we cannot see the gas car at all. How many gas cars does one meet in the course of an afternoon's drive, with enough noises emanating from the hood to supply a boiler works? To the driver of such a car, the vibration and mechanical noises to which he is accustomed are conspicuous in the steamer by their total absence. As long as the engine is supplied with its steam, it goes right on doing its work without obtruding itself upon the driver's consciousness at all. This absence of sensible effort on the part of the engine lends to the driving of a steamer a peculiar charm which the gas car can never possess.

It is argued that the steamer requires more care than the gas car. Of course to state that the steamer demands little attention would be the wildest hyperbole. But it is easier to keep pumps and piston rods packed than to keep valves properly ground; it is easier to keep vaporizers clean than to remove carbon from cylinders. Both cars require attention, but the steamer surely gives a longer ride for each hour spent puttering with it than does the gas car, provided both are kept in first class condition and the time spent by others than the owner is counted. The steam owner usually does this work himself, and a certain type of owner would of course find it irksome. For the man who objects strongly to the little operations that are taken as a matter of course by the mechanical man, who wants to press a button and get there, doubtless the gas car is preferable; he can keep it in such condition that it will run, somehow, with a minimum of effort on his own part.

But to keep the gas car in the condition which the careful owner of mechanical bent would exact is something else. For while the fundamental principle of the gas car seems simpler than that of the steamer, since it generates its power by direct combustion rather than through the agency of a secondary vaporization, in its construction it is vastly more complicated. One convert from the gas to the steam car speaks as follows:

"I have driven my car over 14,000 miles since May, 1915. In securing that mileage I have many times been stuck on the road or in the garage by such troubles as are inevitable with spark plugs, magneto, carburetor, valves and valve springs, clutch, transmission, and rear end. The self-starter, in particular, has been such a nuisance that I now use the storage battery for lighting only and prefer to crank the car. Some sort of repair, replacement, or adjustment has been necessary almost every week, and had I not been situated near an excellent service station, I should have had much more trouble. I notice that many of my neighbors have had similar difficulties, in some instances so onerous that they have disposed of their gas cars in order to stop the drain on their finances.

"It seems to me that the steamer is superior because it has so few parts to get out of order. Electrical troubles are limited entirely to lights and horn; a storage battery for lighting only will seldom give the great amount of trouble that one designed for starting and lighting usually causes. It is not true that the kerosene burners have to be cleaned frequently. Several times a year it is well to pass a fine wire through the nozzles, but that is all the attention needed. Possibly once a month the boiler has to be blown off. The oiling system needs refilling after the car has run upwards of 2,000 miles, not the adding of a pint or a quart of oil every little while, as with gas cars."

The question of starting is not so serious as Mr. Wilson supposes. To begin with, a single filling of the pilot is sufficient for four days, not two. Even if it were not so, an owner who begrudges a trip to his garage every other day would better not have a car if he can't afford a chauffeur. And as for cost, experience shows us that if the pilot were kept alive 24 hours a day for 365 days of the year, and if the car's mileage in that time were only 10,000, the cost for fuels would be just about the same as for a 20 horse-power gas car in use throughout the year in all kinds of going.

It takes from four to twenty minutes to get a gas car out of the garage. During this time, in summer, even a cold steamer could be started, provided one thinks to light the pilot first, before attending to tires, grease cups, etc. In winter, on the other hand, an hour is frequently spent before the gas car will start, whereas continuous burning of the pilot allows the steamer to be started promptly, regardless of the temperature. Freezing can be easily prevented, even if the pilot is not kept burning; a very little heat from a gas jet will suffice if the car is properly housed and blanketed, or if it is used but seldom the water can be drained off. Plenty of gas owners have to do all these things.

Tire wear is *not* excessive on the steamer because it has "too much power." The control is so perfect that the good driver never has too much power—he always has just the right amount. In the gas car the clutch is engaged three times in starting, and repeatedly on the road; at each engagement there is a forced adjustment of engine speed that takes it out of the tires. Other strains are caused by the inherent irregularity of drive and by the necessity for rushing hills; the driver takes sharp turns and stony roads at high speed to avoid losing headway on approaching an acclivity. In spite of greater weight on the rear axle, the steam car is conceded to be easier on tires than the gas car.

No one has ever designed a piece of machinery that will run indefinitely without attention of any sort. The car owner must expect to give his car a reasonable amount of care. And it stands to reason that in the steam car, with only thirty-two moving parts, there is far less likelihood of trouble than in the gas car, with its multitudinous moving parts, to say nothing of the complicated accessories and electrical devices, failure of any one of which will impair or prevent operation.

While the steam car is well available for the man who likes a lively drive and a little fun, its best field is found in its use by the man who prefers to drive at a reasonable pace without being penalized for his lack of the speed mania by being deprived of the use of 85 per cent of the power of his engine—without being continually pestered as a horseman would be if his mount had no pace but a trot, and could not walk without stumbling, or stand still without falling down.

Steam Car Owners.

The Porous House vs. The Hermetically Sealed Dwelling

To the Editor of the Scientific American:

I have read with interest Mr. George H. Cushing's article, "Heating a Porous House." I would like to ask him how he would ventilate a house built as he thinks it should be? Did it not occur to him that he might lose in doctor's bills through lack of ventilation what he would save in coal bill?

Parlin, N. J. G. E. Webster.

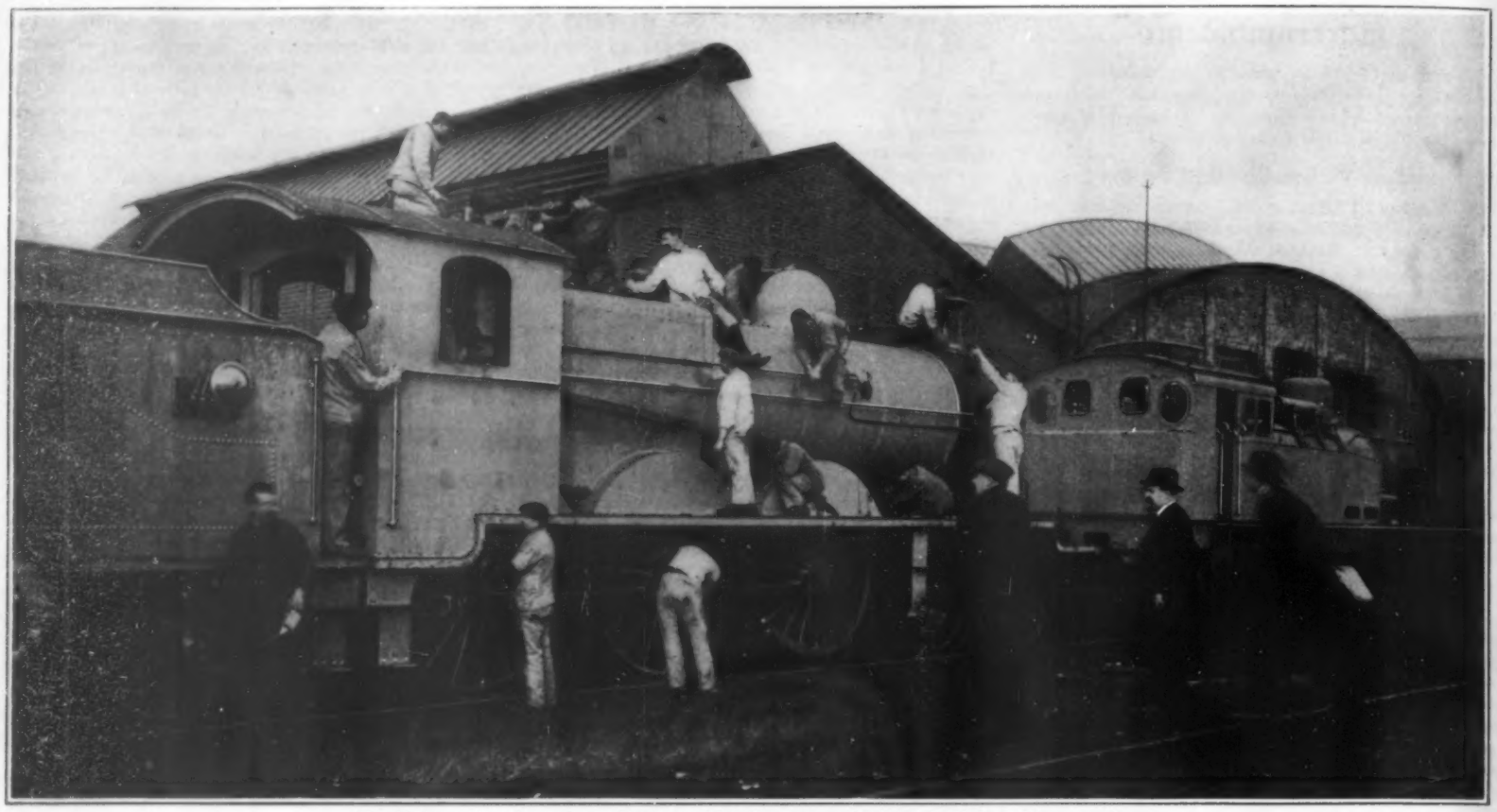
[We do not think that Mr. Cushing's ventilation difficulties would be as serious as our correspondent implies, since doors and windows, rather than leaking walls, are ordinarily employed for this purpose. It is not Mr. Cushing's proposition that these be done away with, but merely that they be distributed with judgment, and made so that when closed they shall be tight. It is plain, however, that Mr. Webster has called attention to a danger which would lie in over-enthusiastic application of Mr. Cushing's suggestions. It would seem to be a very nice problem in maxima and minima to determine just the proportion of window space to wall space which, in a given location, would afford the best combination of warmth and ventilation the year around.—The Editor.]

The Current Supplement

THE current issue of the Scientific American Supplement, No. 2144, for February 3, presents a most satisfying profusion of valuable matter for the intelligent reader. Everyone is interested in the problems of evolution, for they involve every form of life. In this issue will be found an article on *Evolution and Mendelism* that discusses a number of interesting points, particularly those relating to the responses of organisms to changes in stimulation. Another important article is *The Planetesimal Hypotheses* which deals with the result of the close approach of two suns. It is profusely illustrated by plates and diagrams. An interesting companion article is on *Two Important American Observatories*, which gives some account of the Yerkes Observatory and of the United States Naval Observatory. This article is also accompanied by a number of excellent illustrations. *Treatment of Over-exposed Photographic Negatives* is a valuable scientific paper that deals with the prevention of reversal and solarization. *Can Water be Measured by Passing an Electric Current Through It* is an original article describing some experiments carried out with a view to solving an important problem, and the results obtained. It is accompanied by a number of explanatory diagrams of the apparatus employed. The series of lectures on *Vibrations, Waves and Resonance* is continued.

Illumination in Steel Plants

THE Public Health Service has been making a study of the various systems of illumination installed in steel plants and their effects upon the eyes of workmen. Some of the forms of light are of great intensity, accompanied in many instances by marked contrasts, while others are suspected of being injurious on account of their spectral composition. Photometric readings have been taken of the various industrial lights employed in such plants during the various stages of manufacture, and data have been collected regarding the precautions now used to protect the eyes of the workers The service proposes to issue recommendations with a view to mitigating these hazards.



The Hohenzollern Locomotive Factory. Showing new engines just built for military service

Economic Conditions In Germany—III

Her Industrial Mobilization

By Albert K. Dawson

Photographs copyrighted by Brown and Dawson

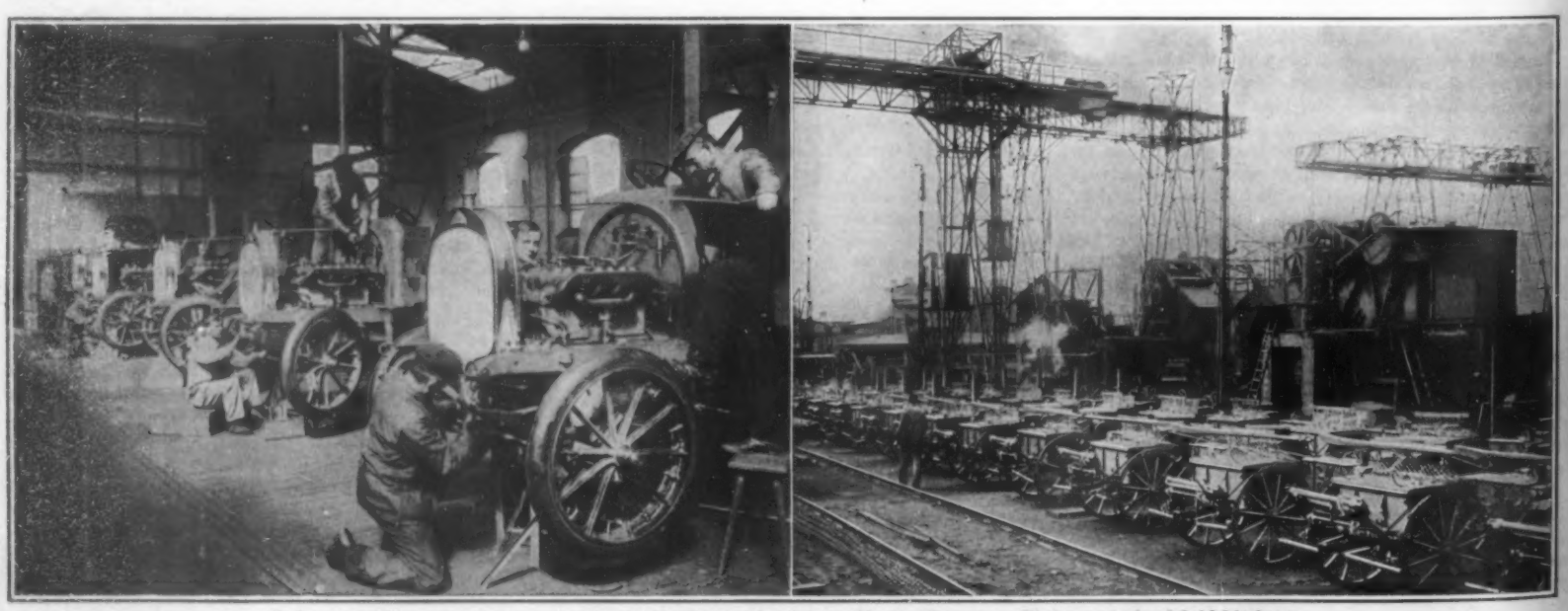
GERMANY is justly proud of her industrial mobilization during the present war—prouder of this, I believe, than of the achievements of her arms in the field. Germany is an industrial nation. Every German you meet is either engaged in making or selling something, and they never miss an opportunity to call the foreign correspondent's attention to the remarkable showing of their own particular line of industry in producing war material of some sort. This is but natural. The military operations are directed by a few and to them goes the credit, but in the industrial field there is all kinds of room for individual effort and individual credit, neither of which the German manufacturer overlooks.

That department of the German Foreign Office, The Press Bureau, which is supposed to take foreign correspondents under its wing and, through personally conducted trips to the front, show them how the fighting is done, is also afflicted with this national pride of Industry, as many a correspondent will regretfully admit.

Take my own case as an example. It was in the dead of winter and after several weeks of anxious waiting I received a formal note from the Foreign Office saying "be prepared for a four weeks' trip to the front to start next Monday." I rushed around and had myself measured for a field suit, riding breeches and Norfolk jacket, like those I had seen Richard Harding Davis wearing in all his pictures; sleeping bag, fur-lined overcoat, leggings, woolen cap, muffler and auto gloves. When I got it all on I looked like Peary on his home coming. Then after writing out a brief will and leaving full instructions for the disposition of my body with the hotel clerk, I looked at sun, moon and stars for the last time and reported at the Foreign Office, feeling rather shaky. I was not alone, for there were nine of us on that trip and as each was dressed according to his own idea of trench life the costumes were startling. One fellow had a big lump under his left arm which turned out to be a gigantic revolver in a pocket scabbard.

After all this preparation, out of the four weeks we were away we were just two days on the front. The rest of the time we visited the principal cities of southern Germany. In each of these we were met by committees from Town Councils, Chambers of Commerce or other booster organizations, who rushed us around on prearranged schedules, trying to show us as many factories as possible in the time at their disposal. Düsseldorf, I think, held the record. There, we were loaded into cars and did eleven factories and one brewery. We would have done more had they only left that brewery till the end of the program; but when we got there the party could not be budged any farther. Each factory manager loaded us up, in their thorough Germany way, with all of the catalogues, price lists and other literature gotten out by his particular plant, some of it in seven languages. I packed all of mine into my sleeping bag and when I got back it was full. They gave us lunches, and wined us and dined us in leading hotels and residences with everybody in formal dress except ourselves, as we had only our wild-west costumes along. They probably think that we Americans have strange ideas as to what to wear at a public dinner.

This and other trips I made into the German industrial field proved intensely interesting. I found all sorts of plants and factories turning out ammunition and war material of every description, usually as foreign to their regular line as is possible to imagine. An artificial coffee plant is turning out shells. Factories making tooth paste and toilet preparations are now making explosives. A lighting fixture plant makes



Left, assembling one-ton army trucks at the Hansa Lloyd Auto Works, Bremen. Right, a stock of field kitchens awaiting shipment at Lübeck. Note the huge travelling cranes

fuse timers. A plow factory turns out field kitchens and armored machine gun turrets. Another plant that used to produce pocket knives and fine cutlery is now turning out long and wicked looking bayonets. And so it goes. There is scarcely a wheel or a lathe idle throughout the empire and it seems that every plant, no matter how peaceful its former products may have been, can be turned to some warlike purpose.

These plants are not being forced to work in day and night shifts, nor is the manufacturer obliged to turn out a certain article. Far from it. He is paid, and paid well for his trouble, as the number of wartime millionaires who have sprung up will prove. The government, through the War Ministry, sets the price on a certain needed article and asks for offers to manufacture. If not enough offers come in the price is raised; if it is needed at once the price is set very high as a special inducement for quick production. This is easy for Germany, because the money merely circulates within her own domain. The manufacturer makes a big profit; he buys a war bond with the surplus, and the government gets the money back, which it then pays to him for the next job, and so capital is made to circulate indefinitely.

Proprietor of the Rheinische Metal Fabrik, with his immediate staff, at the gate of the plant

Germany's great industrial strength is not all engaged in making war materials; many are making their regular output and selling to the various neutral nations. This trade has a great influence on the military situation. First, it enables Germany to buy from the outside without sending her gold out of the country; second, it gives her a tremendous diplomatic club to swing over wavering heads. If Holland will not send butter and cheese to Germany, Germany will not send coal to Holland. If Rumania will not send wheat to Germany, Germany will not send agricultural instruments to Rumania. It is certain that this industrial factor kept Rumania in line long after she would otherwise have broken off relations, and it is certain that it keeps others friendly where the mailed fist would not suffice.

There is still a third advantage in her favor. Many manufacturers in Germany have been working away in odd times during the war making their regular line, even though war material is the principal product. The goods so made are stored away against the return of peace; and as the labor of war prisoners, with the use of odds and ends of time and material, brings their cost down to a minimum, they will be rushed out and sold at ridiculously low prices to kill competition and help regain the old markets. This will also go far toward maintaining the German exchange after the war, for she will need to spend many millions abroad.

The above remarks apply especially to the steel and iron trade. Germany has coal and iron in abundance in Belgium and northern France; she has quantities of Russian prisoners for the heavy work. Steel in standard rods, bars and sheets is almost as good as money in the bank; the demand for it does not change with the times as might be the case with other manufactured articles. This output will surely be dumped into the world's markets at the end of the war. It might be well for the American manufacturer to consider the situation and frame anti-dumping laws accordingly. In reviewing the German industrial field the following plants stand out well in my mind as models of their kind in equipment and efficiency.

Frame of a giant German generator, as it would loom up against a five-story building

First of all the A. E. G. (Allgemeine Electrische Gesellschaft) or the General Electric Co. of Germany. Their big plant in Berlin is a wonder. It still turns out electrical equipment for the Central Powers; but in addition it is handling the manufacture of all kinds of precision instruments for the army, artillery sights, range finders, etc., besides shells and time fuses. In this plant as in most others there are many departments where no visitors are allowed on account of the secret nature of the work.

The Deutsche Gas-Motor Fabrik Aktiengesellschaft in Köln stands out in my mind over the many I visited and photographed in that city. Here they make not only the regular lines of industrial engines but power plants for submarines and aeroplanes as well. No cameras were permitted in the submarine engine department.

The Rheinische Metal Fabrik in Düsseldorf is a second Krupp, with the difference that correspondents are gladly shown through the above plant, while no one is allowed farther than the big front gates of the Krupp establishemnt. Here I saw guns of many types and calibers in the making, chiefly field artillery, and succeeded in getting two fine photographs which the censor afterward took away from me. Old Geheimrat Erhart, an inventor of note and the founder of this business, met us very cordially and after posing for his picture sent one of his superintendents through the factory to act as our guide. Here we saw them not only making new guns but repairing and fixing up old ones which had been captured from the Russians.

In the Hohenzollern Locomotive Works we were looked on with considerable suspicion and were not allowed to enter the shops till the manager had been assured that we were not connected in any way with any competing American firms. We found over two thousand men employed here making locomotives to replace those used up by war and for use in the conquered territory. Also some Russian locomotives being equipped with new trucks to fit the German tracks.

The "Union" machine shops of Dortmund were working to capacity turning out propellor shafts for new ships, both for war and commercial purposes. The Phoenix Iron Works of Dortmund employ in war time thirty-seven thousand men turning out everything from barbed wire to armor plate. In the storing yards we saw thousands of tons of steel being stored away against the end of the war. Their system of handling this stock is very good, all overhead conveyors and magnet lifters.

In Charleroi, one of the occupied towns of France, I found the well-known electric motor factory being worked for all it was worth by the Germans. Most of the motors I saw turned out here were of small capacity.

In Belgium the mines and mills are working, so far as the raw materials will permit. I visted the big La Providence works, rolling mills and coke ovens and found them working three shifts with almost their peace time force. A German officer was in charge of this

(Concluded on page 136)

In the "Union" Machine Shops at Dortmund. Forging propeller shafting for mercantile vessels now building

The ice barricade erected by the railroad whose tracks skirt the east bank of the Hudson River

The thawing out of switches by means of a hydrocarbon torch is an important feature of the railroad's winter campaign

Railroad Defenses Employed Against the Forces of Winter

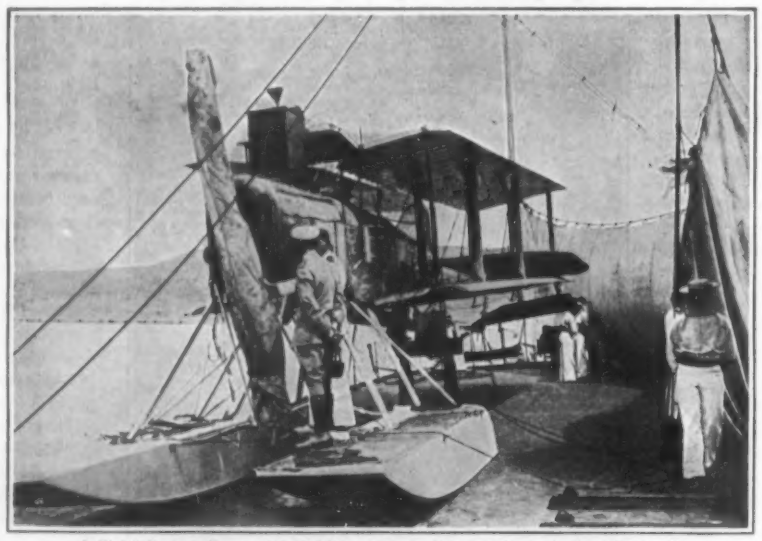
ONE does not have to go to the Rocky Mountain passes nor to the far north in order to witness a battle between the railroads and the forces of winter—ice and snow. While it is true that in the regions just mentioned the railroads are confronted with heavy snowfalls, through which the snowplows must hack their way, foot by foot, before traffic can be resumed, one does not have to go farther than the railway yards and the tracks leading into New York city and adjoining cities to learn that winter means much additional work for the railroad man. And if the work around New York lacks the spectacular touch, one may rest assured, nevertheless, that the battle is being waged with the same care as elsewhere.

The railroad tracks that skirt the east bank of the Hudson River, for instance, must be protected against the cakes of ice blown up the low embankment by the high velocity winds that sweep across the vast and open expanse of water. With the first signs of real winter the railroad erects a more or less continuous barrier of wood of the type shown in the accompanying illustrations and in our cover design. This barrier, it will be noted, consists of units placed end to end so as to form a sort of fence between the railroad tracks and the river. It is of sufficiently stout construction to withstand the enormous pressure of the ice cakes. Under a powerful wind the ice cakes are sometimes driven up the embankment and the inclined face of the barrier, only to fall down again without reaching the tracks. The fence also serves to prevent the formation of huge snowdrifts on the right-of-way. This odd barrage extends for miles along the Hudson River where such protection is deemed necessary.

It is in the thawing of the track switches, however, that our eastern railroads are mostly troubled during winter weather. Even a small piece of ice lodged between the moving points and main rails of a switch is sufficient to render the switch inoperative, and for this reason the railroads must employ suitable means for thawing out the track system. Kerosene and gasoline have lately been replaced by a new fuel which is a by-product of Pintsch gas. It is a hydrocarbon liquid formed by the compression of the gas employed in illuminating railway coaches, and it burns with a flame several times hotter than that of the fuels which it has displaced. It is a common sight in winter to see track walkers going about with their torches, melting away the troublesome ice from between the operative parts of every switch.

A Seaplane with Folding Wings

OWING to the large number of seaplanes employed by the Entente naval forces in the present war, especially in the waters of the Near East where the accompanying illustration was secured, the British and French aircraft designers have developed a special type of hydroaeroplane provided with folding wings. This feature results in a great saving of space on board a warship or special mothership, when a large number of seaplanes are carried. The wings, it will be noted by studying the accompanying illustration, are hinged to the fuselage so that they can be swung back when the craft is to be stored away, yet the seaplane can be made ready and equipped for sustained service in the space of a few minutes by the aviator and his corps of assistants.

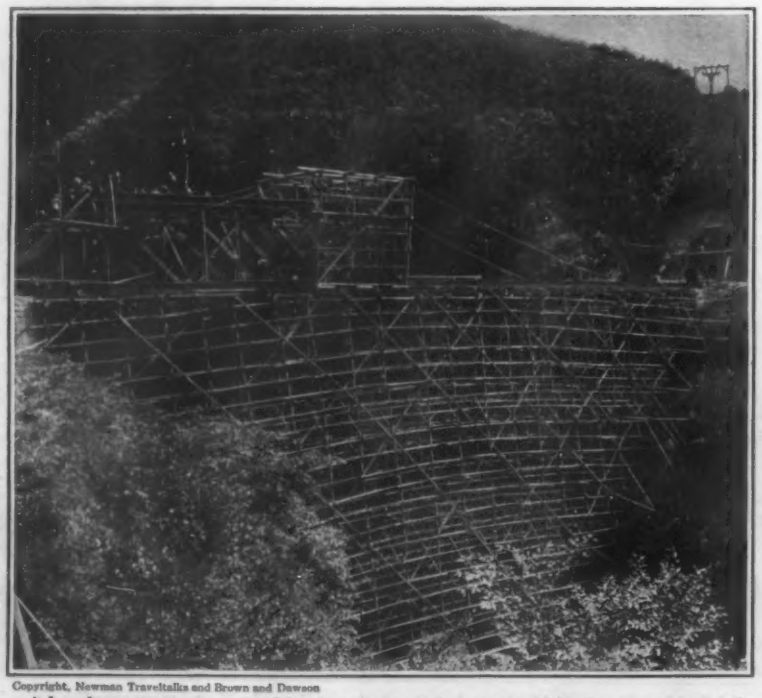


A British seaplane with folding wings, "somewhere in the Orient"

Building a Railroad Bridge of Grass to Expedite the Construction of a Steel One

OCCIDENTAL engineering undertakings of to-day find expression in various forms of steel work, but in the Orient bamboo construction still holds sway as of old. It is a fact, however, that bamboo is fast giving way to steel and iron in the Far East; and the trade of iron worker is fast becoming a common one.

Not far from Miyanoshita in Japan there is a deep gorge which has been spanned by a steel railroad bridge. During construction the Japanese engineers decided on the unique expedient of erecting a temporary trestlework of bamboo, which might be used until the steel bridge was completed. The illustration shows the bamboo trestle and a section of the steel bridge. From track level to foundation the bamboo structure measured 125 feet while the span was about 400 feet. The present bridge is situated at 1,500 feet above sea level. Since, botanically speaking, bamboo is a species of grass, this trestle may be said to be built of grass.



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A bamboo structure erected by Japanese engineers to aid in the construction of the steel bridge appearing at the left

Precision in the Treatment of Wounds

THE problem of sufficient sterilization for shot and shell wounds has been the *bête noir* of the military surgeon ever since the war's beginning. Great delay in healing is the least of the consequences when these deep cavities become infected; permanent disfigurement and disability are frequent, amputation and death only less so. Not only is the task of effective disinfection an extremely difficult one with any of the methods heretofore used, but it actually has been impossible for the surgeon to do much more than guess as to when all danger of suppuration is so remote that the wound may be closed.

Dr. Alexis Carrel, who has made such a name for himself in other medical fields, has now perfected a new method which eliminates all this. He has devised a tube system by which thorough irrigation of the deepest wound is made easy. This consists of a trunk tube with a number of branches, closed at the ends, but perforated along their lengths; when these are arranged in the wound, the operator is able, by simply pressing the bulb which connects the main tube with the source of supply, to force the antiseptic fluid into every part of the affected tissue. This irrigation is performed for a period of two hours daily, usually with a solution devised by Dakin and consisting of a one-half per cent solution of hypochlorite of soda. This solution is non-irritant and in every other respect appropriate for use in this connection; it does not deteriorate with age and it is cheap.

The certainty that additional infection cannot take place and that improvement will be continuous and permanent gives the microscope count of germs a new significance. The surgeon need no longer make any mental reservation in closing a wound, nor wait an undesirably long time for the development of possible infection. The instant the daily count shows that it is safe to close the wound, the sewing is done. The long exposure of the raw edges which makes the process of natural closure a slow and difficult one is thus obviated, and complete healing follows rapidly. Indeed, so confident are the users of this system that it has reduced their work to a mathematical basis that the surgeon on occasion orders a wound closed without looking at it, simply from inspection of the germ count.

A Vegetable Partnership

Some Data on the Lichens, Recently Proposed in Germany as a Source of Food

By Albert A. Hansen

THE shortage of food in Germany due to the present war has caused a great deal of investigation on the part of German scientists to find suitable substitutes for staple articles of diet. One product of this investigation is the recent work of Dr. C. Jacobj, published in two volumes under the captions "The Lichens of Germany as Food and as Fodder" and "Reindeer Moss and its Utilization as Fodder."

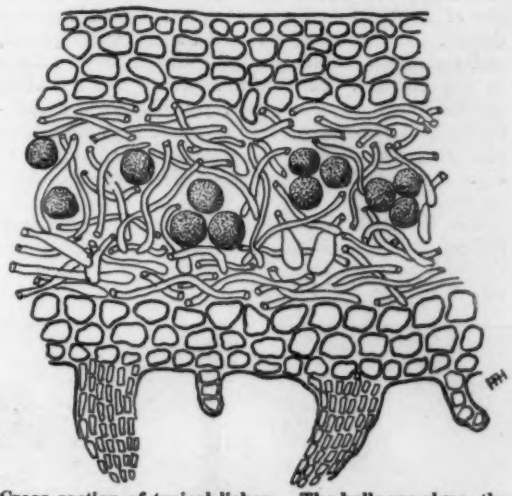
In these books it is proposed that the lichen, commonly known as Iceland Moss, be utilized as food for man in the form of flour from which bread may be made, and that Reindeer Moss, another lichen which grows abundantly in some parts of Germany, be used as fodder for animals. The reports which have reached this country regarding these books have aroused a great deal of popular interest in the lichens. It is the purpose of this article to state briefly some of the most important facts regarding this highly interesting group of plants.

Lichens have long been known and described. They are among the commonest of our plants, being found from pole to pole and in all sorts of situations from bare rock to rich forests. In every clime from frigid to torrid, on exposed ledges and on practically every tree in our forests, the lichens exist in abundance. They usually form their greatest display on the north side of the tree, a fact which has frequently been found valuable, especially among the Indians and the early settlers, as guides in the forest.

Structurally, a lichen is exceedingly interesting; it is essentially a partnership of two plants, a fungus and a green alga. The alga is held captive within the mass of fungal threads; this explains the greenish color assumed by the lichens during wet weather. The alga, being ordinarily an independent plant, is able to manufacture food, some of which is given over to the fungus. In return the fungus protects the alga and supplies water, thus paying in part for its keep. Since the alga can live independently of the fungus, but the fungus is entirely dependent upon its green companion for food, it is probable that the algæ are held in more or less of a captive state; in some species attempts are apparently made to escape. In a great many cases, however, the alga seems satisfied to remain a member of this curious plant partnership. In only one case, that of the Cora lichen of Brazil, has it been demonstrated that a lichen fungus is able to live independent of the alga companion.

The lichens are remarkable for the great age to which they attain. There seems to be no accurate data concerning the time necessary for these plants to die of old age. Individual plants have been carefully watched for twenty-five years, with no apparent change in their size. In the minds of some, the age of members of certain species of lichens can be estimated in centuries, this being especially true of the highly colored rock lichens. It must not be supposed, however, that all lichens are slow growers; some attain large sizes in a short space of time. The study of lichens on tombstones often gives us a clue as to the age of the plant.

The reproductive methods of these organisms are extremely interesting. Upon their surface, dust-like masses of what are technically termed soredia are frequently found. Each tiny soredium consists of a few fungal threads surrounding one or more algal cells. These soredia are scattered by the wind or rain, each soredium being capable of creating a new lichen. The commonest method of reproduction, however, is by means of large numbers of spores produced in the tiny saucer-shaped fruitig bodies, which may frequently be observed on the surface of the plant body. These spores are disseminated by wind or rain, finding ready lodgment in the crevices of rocks or bark. Upon germination, it is necessary for the tiny germ tube to come into contact with cells of the proper alga in order to produce an offspring. This is usually not so difficult as one would at first imagine, since at least one of these algæ, the *Pleurococcus*, is of such common occurrence in nature as frequently to form a greenish coating on fences, the bark of trees, etc. In fact, one of the first methods of demonstrating that lichens are really two plants instead of one was the bringing together of appropriate lichen germ tubes and algal cells. These experiments were first performed by Schwendener and Bornet in 1868 at the suggestion of the eminent botanist, De Bary.

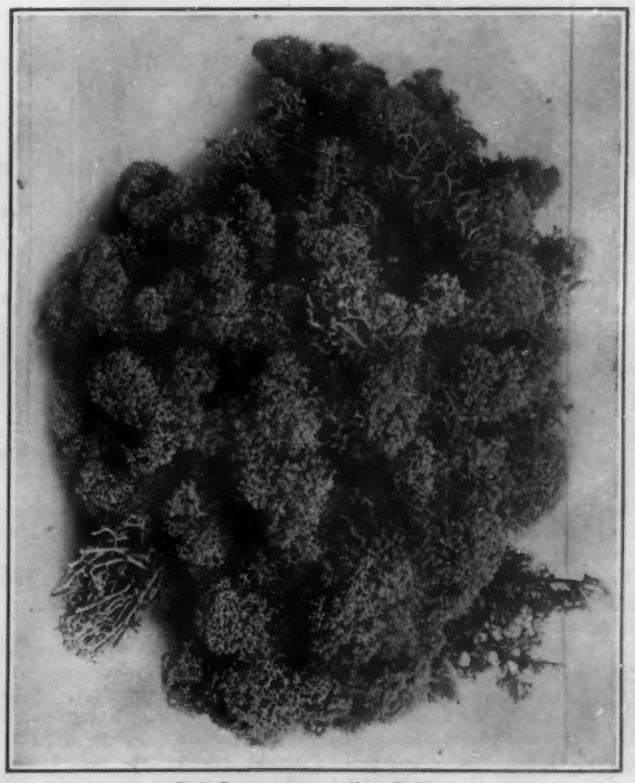


Cross-section of typical lichen. The balls are algae, the rods fungi. Below are seen the root-like processes for attachment to rock surfaces

Masses of the soredia by means of which the lichen effects its asexual reproduction

Old Man's Beard, the most picturesque of all our lichens. Specimen from northern Wisconsin

Ramaline, a lichen abundant on living and dead trees throughout the western states



Reindeer moss, really a lichen

Previous to 1868, scientists held most peculiar ideas regarding the nature and origin of lichens. The old doctrine of spontaneous generation was especially applied to the lichen group. They were accused by the most eminent philosophers of being created out of solid rock. Still others believed them to be the product of decomposing water. The algal cells were generally looked upon as reproductive bodies, even the term spores having been applied to them. From about 1825 these views came to be regarded with some suspicion, but little doubt was openly expressed, since no one had better theories to offer. Since the researches of Schwendener and Bornet, however, it has been conclusively demonstrated that lichens do consist of a dual plant alliance, in which, as has been previously explained, there appears to be a distinct division of labor.

The economic importance of this remarkable group of plants is far greater than is ordinarily realized. The first record of their practical use is contained in the Bible, since it has been almost definitely demonstrated that the manna which was such a boon to the children of Israel was the Manna Lichen, known scientifically as *Lecanora esculenta*. During certain seasons of the year, this plant dries and hardens, forming warty grains, which fall in showers from the mountain sides into valleys; these are used as food in Algeria, southwest Asia, and the Steppe region. The grains form an acceptable substitute for corn. The Manna Lichen is famous for its ability to withstand heat, a temperature of 70 degrees C. being insufficient to cause death.

The ancient herbalists studied the lichens with the view of using them as medicines. The influence of this is still felt, as it is common belief among some people that any real or imaginary resemblance of lichen to some part of the human body can be used as a cure for any disease of the resembled part. Thus the Lung Lichen (*Sticta pulmonaria*) is famous as a cure for lung troubles. The Old Man's Beard (*Usnea barbata*) was until recently used to promote growth of hair. The Yellow Wall Lichen (*Xanthoria parietina*), finds use as a treatment for jaundice; and on account of the resemblance of the marginal fruits to canine teeth, the Dog Lichen (*Pelligera canina*), has been considered as a specific for hydrophobia. Some of the lichens do occupy a legitimate place as sources of medicine, as for instance the Iceland Moss, the extract from which is used as a stomach medicine. Their therapeutic use, however, is rapidly declining.

The lichens are justly famous for their work as soil formers. Usually they are the first plants to attack bare rocks. Into the microscopic fissures of the rock they send tiny processes called rhizoids, which enlarge these crevices by the secretion of acids. The entrance of moisture, with the consequent expansion due to freezing, chips off minute frag-

(Concluded on page 155)

German Military Rifle Practice

Why the British Soldier Is a Better Marksman than His Foe

By Edward C. Crossman

MANY and varied are the epithets hurled by the Britisher at his stubborn German friends across the North Sea. He is a kinsman of Attila, a cannibal, a burner of convents—even a killer of foxes, but worse than all of these things Fritz is alleged to be, he is a poor shot. That's the last straw that ought to crush him.

All these things the Britisher calls the German as a matter of course, but the epithet of being a poor shot John seems to feel ought to shame the German out of the war. One of the irritating phases of the great fight is the fact of being potted by a man who cannot shoot.

The evil reports regarding the German rifle shooting skill began with the peaceful Sunday morning in August, 1914, when the German rolled up his massed attacks on the British positions at Mons, and the trained and cool and skilled British regular regiments rolled them back again.

"They can't shoot for nuts," cackled the Britishers as they hastily evacuated their positions that night under terrific artillery fire, and the flanking pressure of enormous superiority in force, and "They can't shoot for nuts" is what the Britisher wrote home when the following Germans gave him time enough to breathe and even think about writing letters.

National prejudice aside, there is no doubt that the fine shooting of the hardened and skilled British regulars of the first expeditionary force saved their bacon from the vicious and never ending attempts of the following German corps to gobble up French's "contemptible little army." There is no doubt that the shooting of this body of British soldiers, the finest force ever put into any stricken field, did make the German infantry shooting look foolish. There is on record by an intelligent and unprejudiced correspondent, Frederick Palmer, the horrifying slaughter of the charging Germans by skilled shots of the Canadian veteran regiments, the Princess Pats, in the Ypres battle.

Time after time in the British retreat from Mons to the Marne the German dachshund pack caught up with the British procupine—and thereafter muchly regretted the fact of said catching up. Straight rifle shooting and efficient use of the comparatively small number of field guns saved the British bacon. For nearly a hundred miles a force immensely superior in all arms, and presently backed by siege howitzers never dreamed of in British philosophy, chevied the tired English soldiers along the roads of Northern France, soldiers without even the comfort of feeling that their flanks were secure. Yet the German bag consisted mostly of quills—painfully acquired.

Some of the British findings with regard to the German shooting efficiency were merely in line with what the British expected to find. The Germans, never entering a team in any of the great international rifle matches such as Bisley, Stockholm or Camp Perry, and never following the noble sport of long range rifle shooting, therefore, could not shoot. When war broke out and the German infantry turned out to shoot about as poorly as the infantry of most other nations not of Anglo-Saxon breed, then the tickled Britisher dodged a few pecks of shrapnel bullets, nicely placed, and exclaimed, "Told you so." Conan Doyle affords us one example. Possibly a desire to avoid hurting the feelings of a gallant ally, possibly British stubbornness in recognizing the full truth, kept John from admitting that if the German infantry shot any worse than the French infantry, it surely "couldn't shoot for nuts."

The German, with his intense desire for efficiency and possibly a mistaken notion as to what constitutes efficiency in some lines, designed the rear sight of his rifle so no man could do fine shooting, or stand a show in a long range rifle match, even if the desire, so foreign to the German, should enter his breast.

The rear sight is so arranged that a man with enough intelligence to feed himself and button his clothes could set it instantly to any given range. The sight then kindly locks itself into position. It is strong, very strong, and very simple. It is devoid of fine gimcracks, such as wind-gages and devices for making fine changes in elevation. Also, the most expert rifleman in the world, using one in front of spectators in the endeavor to make a good score at 1,000 yards, would speedily give vent to frenzied yells and assault the nearest solid object with the poor rifle. As a matter of fact, although sufficiently accurate for military shooting, the German rifle will do little more than stay on the six-foot target at 1,000 yards.

The German rear sight, like the rear sight of every other nation outside of England, Canada and the United States, is a bar with a large and generous "V" cut in it.

The elevating arrangement, moving along a graduating bed on the barrel of the rifle and raising the arm on which the bar is fastened, allows of no changes less than 100 yards.

At 1,000 yards a change of 100 yards on the rear sight moves the bullet approximately 100 inches on the target, and so the poor target man, hitting the six-foot paper a little low, would have no alternative but leave the sight where it was or else move it up 100 yards and go two or three feet over the top of the paper. There is no windgage.

Immensely practical, this sight, but not one to encourage fine shooting or long range work such as is the delight of the American and the Canadian and the Britisher—and lately of the Argentino.

The German recruit in times of peace was first given the same preliminary instruction that the American recruit receives—the rifle and its parts and manipulation, the theory of the cartridge and its action, and then how to aim the empty rifle.

Then he graduates to light loads, called "Teilmunition," using very light powder charges and hollow lead bullet, about equivalent to the American .22 "sub-caliber" army rifle used for the same work.

With ball cartridge the longest range used in German rifle instruction is 435 yards. Longer ranges are used in their field firing—"fight shooting," as they term it, but the distance stated is the limit for the regular target work.

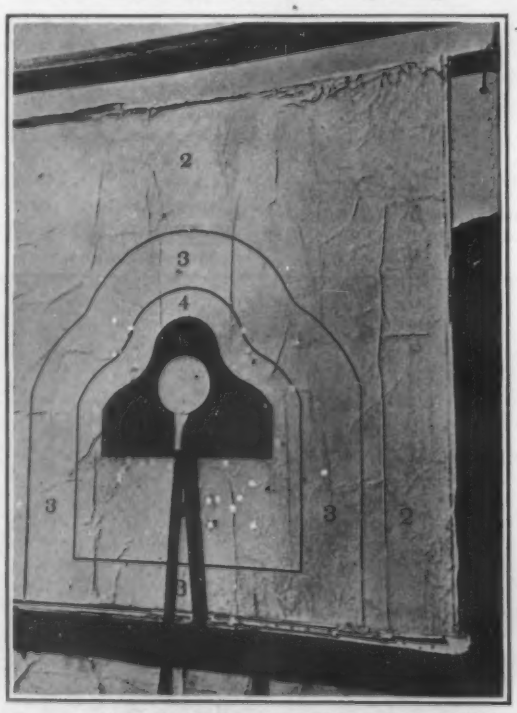
In his first year the recruit is in the second class, and starts his actual firing at 150 meters, about 165 yards. The target facing him is 4 by 5 feet, with annular divisions, the 12-ring being 2 inches across. Beside this target is another of the same size, but using the head, face and part of the shoulders of the figure of a prone man, reddish brown in color. From the breast at the bottom to the top of the head, the available mark, is 12 inches. Around head and shoulders run the rings counting the same as those of the ring-target.

Firing three shots from rest, the recruit must score 27 points, with no hit below a six. Without rest, passing the first test, he must score 21 from the prone position. Queerly enough, they also instruct the recruit in offhand or standing work, whereas the American Army, usually toddling dutifully along the path pointed out by Von Der Goltz, does not teach this position at all. The next stage is 200 meters, prone and kneeling, using the head-target, and finally offhand again at the 200-meter distance.

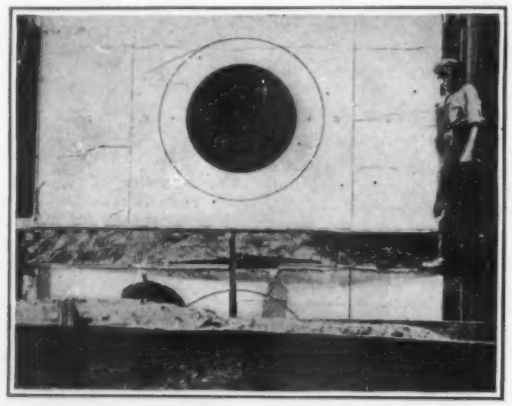
Passing this preliminary stage, then at 200 meters prone the soldier must score 30 points, with no hit off the target, to advance in the class. The minimum hit

(Concluded on page 137)

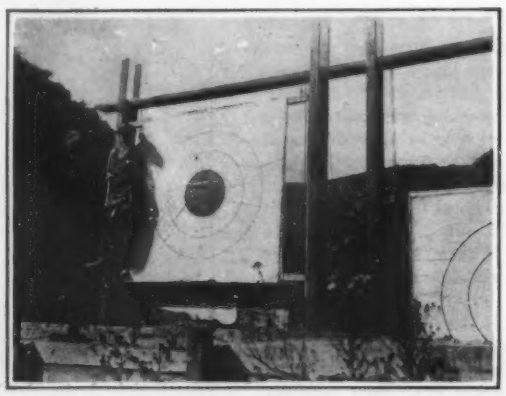
American target for 200 and 300 yards. Bull's-eye of 8 inches makes it unsuited for longer range



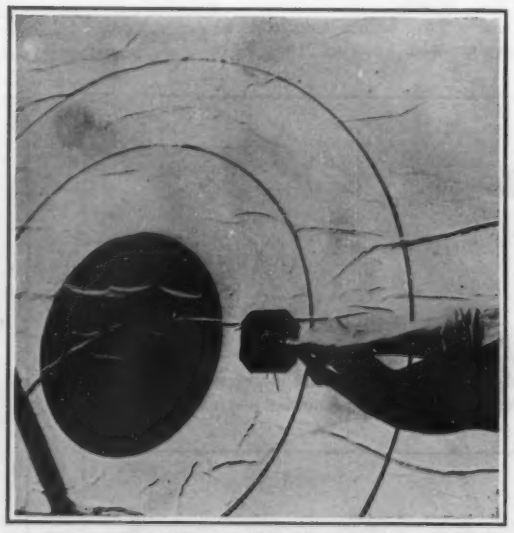
German silhouette target representing man, prone and facing shooter. Note marker in operation



American and British long-range target with 3-foot bull's-eye



American middle-distance (500 and 600 yards) target with 20-inch bull's-eye.



Placing spotting disk on bullet hole, where it is held by the wire, to show the marksman where he hit

Woman In the Industries

How Far Can She Go, and What Does Her Presence There Mean?

IT has for a year or more been clear that the present war is to have an unforeseen economic effect of far-reaching import in the extension of woman's field of employment. Throughout the warring nations literally hundreds of trades which have always been closed to female workers are now of necessity being carried on largely by girls and women. When the fighting is over and the men workers return to their homes prepared to reclaim their places in the industrial fabric, a critical situation will exist. Will the girls and women who have learned new tasks possessing greater interest and returning better pay than their earlier employment willingly return to domestic labor and poorly paid operation of automatic machinery? Will their employers willingly exchange their services for those of the men?

Only time can answer these questions, and tell just what economic turmoil will result from the sudden influx of workers which the end of the war will create. But in the meantime, we on this side of the ocean are in a position to observe some extremely interesting sidelights upon the question of female workers in the trades.

Because of the extraordinary industrial inflation of the past two years, skilled labor has become scarcer and scarcer. Employers have been forced, willy-nilly, to put women and girls to work at tasks formerly closed to them, and which it would never have been suggested, in ordinary times, that they were capable of performing. We reproduce on this page several views from the factory of one of our leading automobile manufacturers, showing the technical nature of some of the work which this concern is now entrusting to women. This work includes the assembling of all wiring, primer systems and switch appartus, the inspection of pistons and all other small parts, and the operation of drill presses and other light metal working machines.

The officials of the company in question are in accord with all other employers who have been forced by the condition of the labor market to employ women for men's work when they state that they would not willingly return to the old regime. This is not due to direct financial considerations, as is so often the case where women replace men in clerical work; for in this instance, at least, the women are paid the same wages or piece rates as were the men. But the statement is made, without reserve, that for all manner of skilled labor requiring close application, great accuracy and considerable manual ability, but no extreme physical strength, women are superior to men. They turn out more work, and better work, in a given time.

We are not psychologists, and do not pretend to be able to account for this. We do not know to what extent the claim is justified that labor unionism makes for deterioration of individual work. We believe that the labor union, under ordinary conditions, affords the worker who is naturally inclined to "soldiering" more scope for the exercise of his talents in that direction than he would have under the old system of stricter individual accountability to the employer. But the importance of this factor would depend upon the proportion of such workers, and consideration of this point would promptly lead us back to the initial statement of this paragraph.

It may be, of course, that the observed difference in favor of woman is due to the novelty of her new employments, and that in time she will wear down to the level of the men. Time alone can tell this. It is suggested, on the other hand, that woman is actually an inherently better worker than man. An even stronger probability is that she is a more conscientious one. We know of an errand girl, hired because boys were not to be had, who covers regularly in less than an hour a route from which her boy predecessors seldom if ever returned in less than two hours. In this particular case, if the novelty element were to enter at all it would seem that it should make for reduced efficiency through greater interest in the sight-seeing aspect of the job.

Girl assembling a small joint by driving in a pin

Skilled female workers assembling complicated carbureters

Another suggestion which we have heard is that the trend of modern industrial development is such as to remove from most operations the strength factor in which the male excels, substituting therefor the skill factor in which, according to the hypothesis, the female has the advantage. If this view be actually justified, it is plain that we are moving toward an unparalleled economic upheaval. In any event, if woman shall ultimately be able only to compete with man on an equal basis in a large number of occupations formerly closed to her, the effect will be fundamental. The working out of the entire situation, both here and abroad, will be well worth watching.

Making Paper Pulp from Hemp Hurds

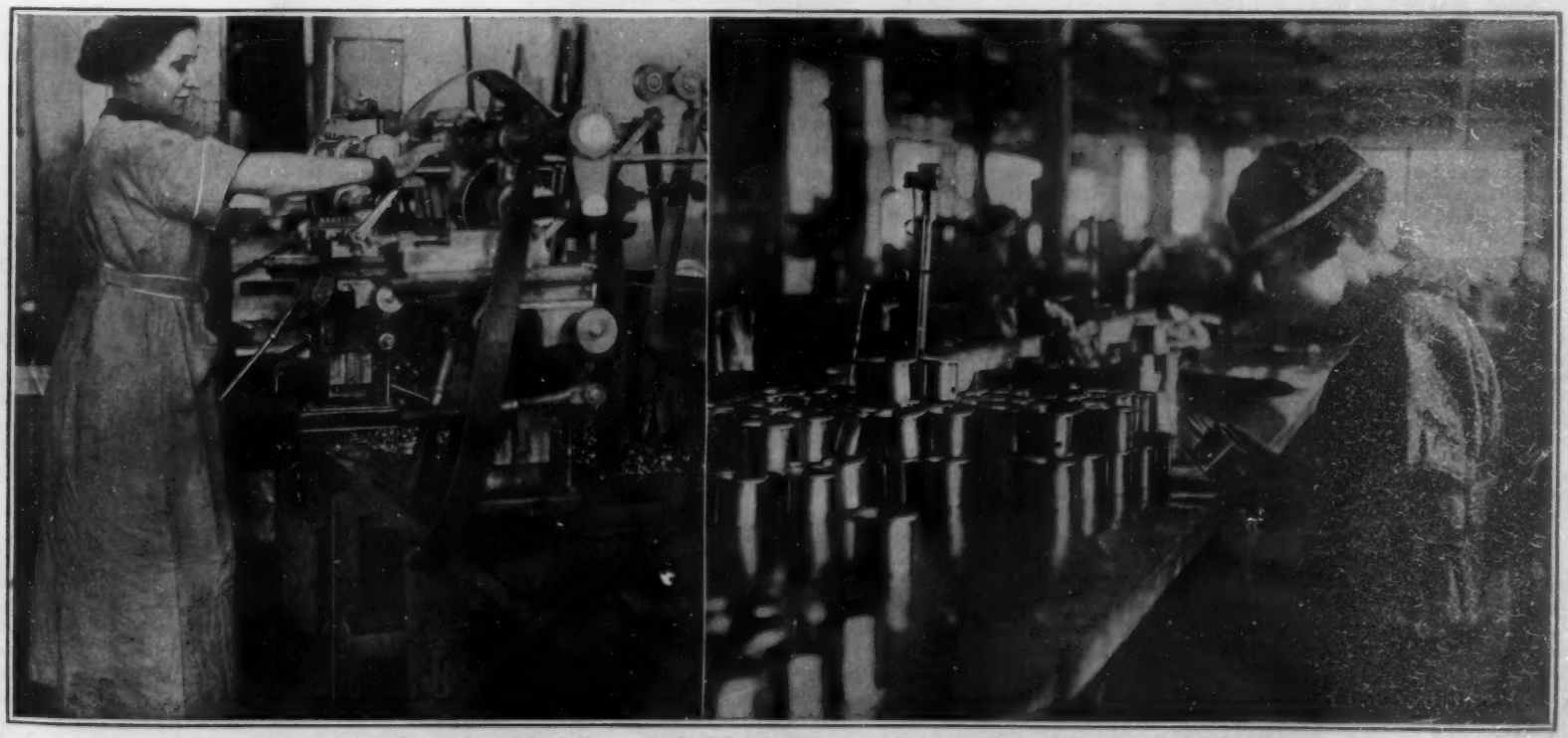
IT is possible that some time in the near future much of the book paper used will be made from hemp hurds instead of poplar wood, according to specialists of the Department of Agriculture, who have just finished a series of experiments made in coöperation with a paper manufacturer.

The investigations demonstrated that the hurds can be reduced chemically to paper stock by the soda process under practices but little different from those used for the manufacture of pulp from poplar wood. Slightly more bleaching was necessary, and beating for a somewhat longer period was found desirable. As against these items of increased expense in comparison with poplar wood as a raw material, the first preparation of the hurds at the mill is less expensive.

Because of the lightness of the hurds, charges of this material in the digesting chamber must be lighter than charges of poplar wood. The experiments showed that the weights of the charges ran about 60.5 per cent of the weight of poplar wood charges. The total yield of air-dry fiber from hurds was 33.1 per cent as compared with about 47 per cent of air-dry fiber from poplar.

Hemp is now grown in Kentucky, Ohio, Indiana, Wisconsin, and California. In Kentucky, however, the fiber is separated from the stalks by handbrakes moved about the fields, and the hurds, therefore, are so scattered that their use for paper making is not economically practicable. It is only in the other States named, where large machine brakes are employed and the hurds are deposited in stacks, that the waste may be drawn upon practically as a paper making material.

Calculation by the Department's specialists of the raw material and acreage necessary for a permanent supply of materials for a pulp mill producing 25 tons of fiber a day for 300 days per year, or 7,500 tons a year, shows that in the case of wood the annual growth from 40,500 acres would be the impressive total required.



Women workers in an automobile factory. At the left, operating a punch press; at the right, measuring finished parts with a micrometer screw

The Heavens in February, 1917

The Parallax of Barnard's "Runaway Star"

By Prof. Henry Norris Russell, Ph. D.

THREE months ago we had occasion to speak of Professor Barnard's discovery of a faint star with the unprecedentedly large proper motion of 10.3″ per year, and of the probability that it would be found to be one of our nearer neighbors in space.

This anticipation has now been verified by the results of direct observation, which show that this star is actually nearer us than any other, with the single exception of our nearest neighbor, Alpha Centauri.

These measures of the star's distance have been made by the usual method of determination of parallax, whose principle is as follows. If we could observe any star from the sun, which is moving uniformly in space, it would itself seem to be moving uniformly in the sky, among the other stars, and along a straight line (or, to be more exact, a great circle of the celestial sphere). But if we observe the same star from the earth, which is oscillating from side to side of the sun as it circles about its orbit, the star will appear to have a similar oscillatory motion from side to side of the direct path, so that its track, if accurately platted on the sky, would appear as a wavy curve. The nearer the star to us, the greater will be the apparent height of these waves, from crest to trough; and it is by measurement of these that the distances of the stars are determined.

In most cases, it is necessary to obtain observations—so to speak—at the crest of one of these waves in the curve, the bottom of the following trough, and the crest of the next wave, in order to find the true height of the wave and the distance of the star. To do this takes at least a year, for the successive oscillations in the stars' apparent position repeat themselves at yearly intervals, as the earth returns to the same position in its orbit.

In the present case, when the star has been under observation only from June to November, the portion of the curve already covered by the observations corresponds only to the upward slope of the wave, and a small extension beyond the crest. But this time the height of the wave is so great that even this small portion of the whole wave is clearly curved, and the size of the whole wave may be inferred from it. During the present year observations can be obtained at the trough of the wave, and up to the next crest, and these will give much more accurate values of the distance than are at present available. But even now the evidence is sufficient to show clearly that the star is very near us.

Two quite independent determinations are available—the first based on photographs taken at the Allegheny Observatory, and discussed by Professor Schlesinger, and the other based upon the micrometer measures of Professor Barnard, with the Yerkes telescope, discussed by the present writer. Both agree in showing that this star is nearer than any other but Alpha Centauri, the Allegheny photographs giving a parallax of 0.50″, and a distance of 6½ light years, and the Yerkes measures a parallax of 0.70″ and a distance of 4¾ light years. When further observations have been secured, it is to be expected that the two series will give more closely accordant values. The photographic result is probably at the moment the more precise of the two, and it is probable that the final value will turn out to be not far from a parallax of 0.55″, or a distance of 6 light years.

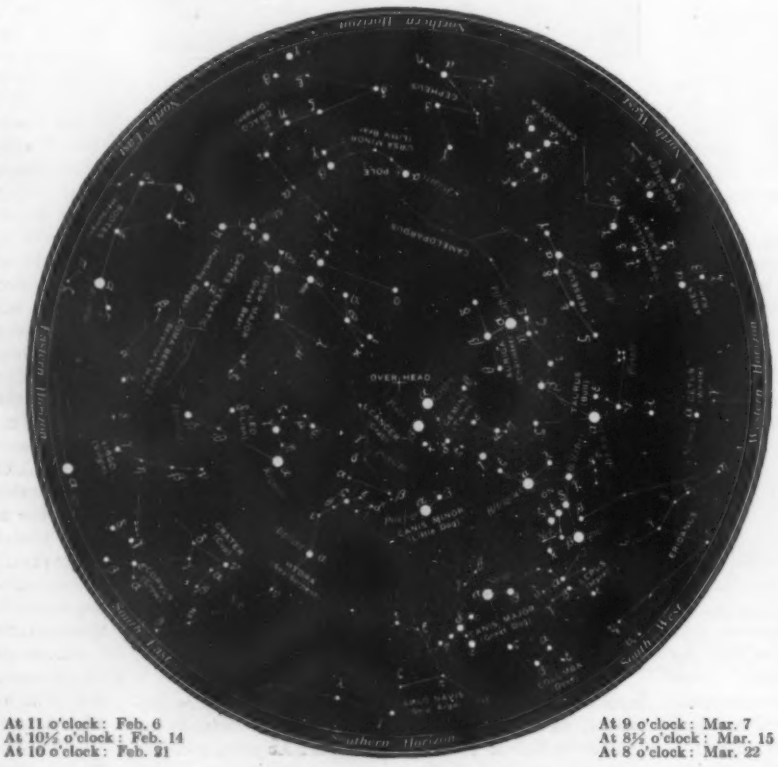
This is 40 per cent greater than the distance of Alpha Centauri, but the next nearest star previously known is again about forty per cent farther away than Barnard's star, so that the new discovery comes about in the middle of the previously existing gap in the list of stars arranged in order of distance.

Assuming a distance of 6 light years for this star, it follows that its actual brightness is about $\frac{1}{2500}$ that of the sun, and its velocity, at right angles to the line of sight, about ninety kilometers per second—enough to carry it from the sun to Uranus in one year. Its velocity of approach toward us, as determined from spectrograms taken at Mt. Wilson and at the Lick Observatory, is 110 kilometers per second. Hence the star is now moving along a line which is inclined at an angle of 39° to the direction of the sun as seen from the star. An easy calculation shows that, if the star continues to move along this line (as it surely will, unless some unknown and unprecedented force should act upon it), it will continue to approach the sun and earth for almost ten thousand years to come. By that time, it will have moved across the sky from Ophiuchus into Draco, will be at a distance of 3¾ light-years (nearer than Alpha Centauri is now), will look a magnitude brighter than it does at present, and will move among the other stars two and a half times as rapidly as at present. Then it will slowly recede from us, grow fainter, and seem to move slower as it draws away into the depths of space.

The Heavens

The brightest part of the sky is now in the southwest and brilliant enough it is. The brightest object in sight is the planet Jupiter, which, however, by one hour of observation is low in the west, and, if the air is hazy, may not look as bright as Sirius, which is but a little past the meridian, and at a much higher altitude. Above Sirius, a little to the left, is the smaller dog-star, Procyon; and above this again the twin brethren, Castor and Pollux. The still brighter object between these stars and Procyon is the planet Saturn.

Orion is the great ornament of the southwest, while Taurus and Auriga, with their bright stars Aldebaran and Capella, are conspicuous on the west—the latter, very high up—Perseus and Cassiopeia may be seen on the northeast, with Andromeda setting below them. Cepheus and Draco are low in the north, while Ursa Minor extends to the right from the Pole. Ursa Major is high on the northeast, with Boötes rising below. In the east are Leo, well up and Virgo, just rising, while Hydra stretches from the southeastern horizon almost to the meridian, and a part of the huge constellation Argo is visible in the south.



At 11 o'clock: Feb. 6
At 10½ o'clock: Feb. 14
At 10 o'clock: Feb. 21

At 9 o'clock: Mar. 7
At 8½ o'clock: Mar. 15
At 8 o'clock: Mar. 22

At 9½ o'clock: March 1

NIGHT SKY: FEBRUARY AND MARCH

The Planets

Mercury is a morning star, and is fairly well placed for observation around the time of his greatest elongation on the 12th. Being south of the sun, however, he rises only at about 5:40 A. M., an hour and a quarter before the sun. He should be easily visible in the dawn throughout the middle third of the month.

Venus is a morning star too, and is quite near Mercury, all through the month, being about 2° east and 2° south of him on the 1st, but slowly drawing farther away till, on the 17th, she is 9° east of him, after which he overtakes her as he draws in toward the sun. Though very low in the dawn, she is so bright that she should be readily seen.

Mars is in conjunction with the sun on the last day of the month, and is invisible.

Jupiter is an evening star in Aries, setting at about 11:30 P. M. on the 1st, and 10:10 P. M. on the 28th. He is perceptibly, though not greatly, brighter than Sirius, and is the chief ornament of the evening sky.

Saturn is in Gemini, on the edge of Cancer, and comes to the meridian at 10 P. M. in the middle of the month. He is brighter than any star in sight except Sirius, and is a fine telescopic object.

Uranus is in conjunction with the sun on the 8th, and is utterly invisible during the month. Neptune is in Cancer, his position being 8h. 22m. 9s. +19° 12′ on January 31st and 8h. 19m. 14s., +19° 22′ on February 28th. He is well placed for telescopic observation, but not very interesting, even with a large telescope.

The Moon is full at 10 P. M. on the 6th; in the last quarter at 9 P. M. on the 14th; new at 1 P. M. on the 21st, and in her first quarter at noon on the 28th. She is nearest the earth on the 20th, and farthest away on the 6th.

During the month she passes near Saturn on the 5th, Neptune on the same day, Mercury on the 19th, Venus and Uranus on the 20th, Mars on the 21st and Jupiter on the 25th—none of the visible conjunctions being close.

No orbit of Metcalf's Comet, whose discovery was mentioned last month, has yet come to hand, though there will doubtless be material to compute an orbit some day. It is, however, so faint as to be of very little interest in any case to the amateur observer.

PRINCETON UNIVERSITY OBSERVATORY.
January 22, 1917.

Ravages of the Fruit Fly in Western Greece

THE Mediterranean fruit fly has wrought great damage in the orchards of the Patras consular district during the fruit season just ending. This is the first time in ten years or more that the presence of this fly has been noticed in this district.

Among the fruits which it has attacked with damage to the crop are the orange, tangerine, peach, pear, and apple. So far as reports indicate no damage has been done to the lemon, citron, or quince. The tangerine crop was practically a failure, owing to the ravages of this fly. The orange crop also suffered severely; the peach and pear crops were a failure.

The ravages of the fly did not affect directly the foreign trade of this section of Greece, since only the citron (in brine) is exported in commercial quantities. The pest had a serious effect, however, upon local conditions. The fruits mentioned constitute an important item in the food of the people, and it has borne hard upon them to have this shortage in their local fruit crops at a time when the cost of foodstuffs in general stands at a high mark.

Earthquake Intensity Scales

A sensible and timely article on this much debated subject has recently been published by the veteran French seismologist, Count de Montessus de Ballore, who has for some years been in charge of the service of Chile. It is the general custom of seismologists to collect, after every important earthquake, reports upon its intensity at various places, estimated by observers according to one or another of the scales now in use, of which the Rossi-Forel scale of ten degrees is the most familiar. On the basis of such reports lines of equal intensity, called *isoseismals*, are drawn on a chart. The central area of this system of curves is the epicenter of the earthquake. But such estimates and reports are extremely misleading. In Chile it has been found almost impossible to draw isoseismals of earthquakes, owing to inconsistencies in the data that is collected from the observers.

"These difficulties do not arise," says the writer, "from the carelessness of the persons who make the earthquake observations; they lie much deeper, for the estimate of seismic intensity is the result of many variable factors, which have no direct relation to the natural phenomena themselves. These factors are the turn of mind and temperament of the observer, the coherence of the subsoil, the mode of construction and nature of the buildings, etc."

Montessus de Ballore advocates the abandonment of the present scheme of scale estimates and isoseismals, and proposes that maps of earthquakes be hereafter drawn to show only (1) the curve or rather the polygon which defines the area of perceptible shaking; (2) the places of maximum intensity or of severest damage, but only when these observations can be made accurately; and (3) the limits of the area of damage, which in all cases can be readily determined with great precision.

Protecting the Traffic Cop

THE life of a traffic cop is by no means a happy or safe one. At any time the guardian of a busy crossing is apt to be run down by some careless motorist, truck driver or motorman. Accidents of this nature are common in all our crowded cities. In view of this fact, it is rather curious, when we stop to think about it, that city authorities who are careful enough of the lives of pedestrians to place policemen on watch at the crossings, have been so singularly neglectful in taking proper measures to safeguard the guardians. Apparently they go upon the principle that the policeman can look out for himself, but this, it has been proved, is not always possible with the best of care.

For these reasons a good many traffic officers will be cheered by the news that a Down-East Yankee has come to their rescue by the invention of a traffic stand for the protection of crossing policemen. It is especially for use at intersections of streets. Besides being equipped with an umbrella as a protection for the policeman against weather, it is in many ways an aid in his work of keeping both vehicles and pedestrians moving smoothly.

It consists of a circular platform standing 5 inches from the ground, and equipped with a guard rail to protect the occupant from any careless motorist who might dash up behind. To guard further against this danger a mirror is attached to the rail at such an angle that the policeman can see at a glance approach of vehicles from rear. For rainy days there are canvas side curtains, also a rubber mat for the cop to stand on in cold or damp weather.

In addition to serving as a means of protection, the stand affords a convenient base for any permanent sign giving instructions to drivers. When equipped with such sign, it may be left for a few moments by the officer and still serve as a guide to traffic. Finally, it is easily moved from one point to another and affords a safety zone for pedestrians who may want to stop and ask the policeman a question.

Doum Nuts of Commerce

AN increased demand for a less expensive button material has brought into commerce a substitute for the tagua, corozo or South American ivory nuts (*Phytelephas macrocarpa*). Substitute vegetable ivory is now being imported into Europe and to a small extent into the United States under the trade name of gingerbread doum, doom or dum nuts of northern Africa, which are the seeds of a common palm botanically called *Hyphenæ thebacia*. This palm and a few closely related species are found throughout northern Africa. They form small trees rarely exceeding 25 or 30 feet in height with stems which are frequently three or four times forked as shown in the illustration. The fruits grow in long clusters, each containing from one to two hundred; they are beautifully polished, of a rich yellowish brown color and are irregular shaped. Practically all shipments of these nuts which have thus far been made have come from Port Said. The Italian, German and French button manufacturers consume more doum nuts than all the other European firms taken together.

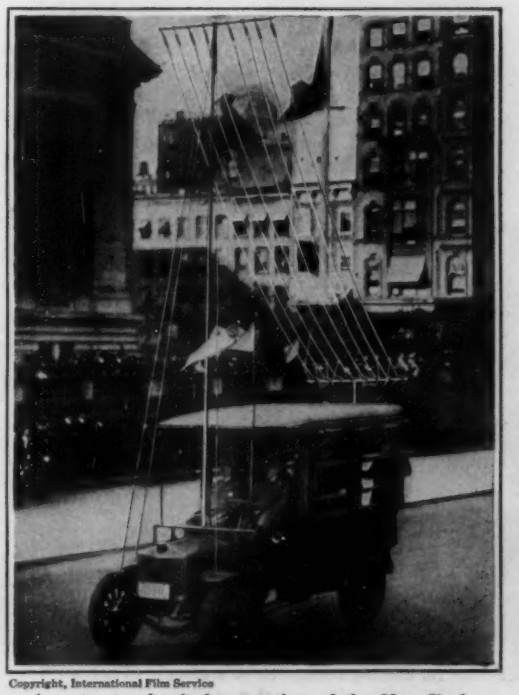
The supply of these nuts is unlimited. They can be bought at about one-third as much as the true ivory nuts from South America. In the Hamburg markets the price fluctuates from 2 to 3 cents per pound, and as the South American kind decreases in the market value the African product decreases proportionately. While the export of these nuts from Africa is constantly increasing, the shipments to the United States have been only in small quantities of ten or twelve tons each. The cheapness of the price is the reason for its introduction, but unfortunately the experiments made have not proved very satisfactory. The machinery installed in the button factories here is made to manufacture buttons out of the South American nuts and cannot be easily adapted to manufacturing buttons out of the African kinds, which are too soft, have too thick a coating, and the hole in the center is too large. The vegetable ivory nut from South America produces on an average fifteen good serviceable buttons, while the African yields only from five to six; and under the present methods of manufacture and treatment the buttons made from the latter occasionally shrivel and warp. It is believed that sooner or later better methods of handling and treating both the raw material and the finished product will enable manufacturers profitably to install new machinery especially designed to manufacture buttons, marbles, and an innumerable variety of small toys and trinkets out of these African nuts, which are not only cheaper but available in much larger quantities than those from South America or from the South Sea Islands.

Wireless Station That Travels Through the City Streets

IN the recent parade of the police force of New York city, a motor truck wireless station attracted more than its expected quota of attention on the part of the bystanders. This was due to the mystery which always, in the mind of the laity, attaches to anything pertaining to wireless telegraphy.

The motor truck wireless station of the New York Police Department is a phase of the preparedness movement. It carries a powerful transmitter and a long-distance receiving set, together with an eight-wire aerial supported by a mast about 25 feet high and another about 10 feet high. The ground connection being impracticable in a transportable station of this kind, reliance is placed on a capacity ground. It is said that the intention of the police is to maintain communication between the wireless truck and the wireless station at headquarters, no matter where the former may be at the moment. Thus in time of emergency it will be possible to maintain uninterrupted communication between scattered forces and headquarters, even in the event of the failure of the ordinary means.

The traffic stand in wet weather and in dry



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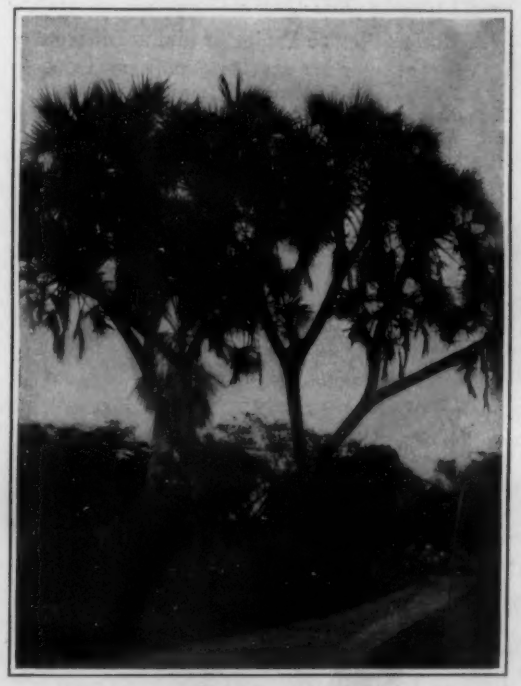
A motor truck wireless station of the New York police force



A doum nut palm tree, the seeds of which furnish material for making buttons

Fertilizers and Microbes of the Soil

THE influence of fertilizers upon the microbes of the soil has not as yet been studied to any great extent, although this subject is one of considerable importance. A French scientist, M. Fred, contributes the following researches to our knowledge in this direction. He desired to find out whether the mineral fertilizers such as phosphates and sulfates have any marked action upon the natural microbian phenomena which occur in arable earth, and he made experiments with pure cultures as well as with mixtures of microbes, and this in natural soils or in artificial media, in order to see whether there was a transformation of usual nitrogenous matter of the soil into ammoniacal nitrogen. When working at the ordinary temperature he observes that phosphates cause a noteworthy increase in the number of bacteria in the soil and at the same time an increase in the quantity of ammonia, but while the effect of phosphate of potash is very marked, that of lime phosphate is seen to be small. Regarding sulfates of calcium or potassium, these act favorably, but the effect is less than with the phosphates. Again, phosphate of potash hastens the formation of ammonia to a much greater degree than sulfate of potash. It seems therefore that potassium does not exert a marked effect on the bacterial mineralization of organic nitrogen. At any rate, M. Fred's researches show that it is possible to assert that the fertilizing action of some of the mineral products used for this purpose is due at least in part to their stimulating effect on the activity of the microbes contained in the soil. Such microbes carry out important chemical changes, and the addition of fertilizers affects the microbes and thus increases the chemical change in the constituents of the soil.

Crystallization of Cold Wrought Steel

IT is a matter of fairly common experience that cold-wrought steel, whether in the form of cold drawn wire or tubing, cold rolled rod or sheet or strip, or cold pressings, is given to occasional breakages for no apparent reason under stresses much below those which might be accounted safe. The trouble has long been known to be due to crystallization, but the conditions governing crystallization in cold wrought steel have until late years defied analysis. Recent investigations, however, are throwing a good deal of light on what has for so long a time been a mystery.

It appears that the formation of coarse grains in the metal is conditioned by the amount of reduction in sectional area which it undergoes in the working, and by the annealing temperature to which it is afterwards subjected; and that there is a danger zone as regards both these processes, within which grain formation may be especially looked for. Reductions of area up to eight per cent appear to have no deleterious effect of the kind mentioned, but at nine per cent, a critical strain seems to occur which is favorable to crystallization. From nine per cent upwards the size of the grains induced by working steadily diminishes, and at twenty-five or thirty per cent they become once more normal, so that reductions of over thirty per cent in area are not found to cause any grain growth. The danger zone so far as reduction of area is concerned is thus found in reductions of between nine and thirty per cent.

It has been further noted that the coarse grains develop during annealing and that their growth is largely dependent upon the temperature at which the subsequent annealing process is carried out. The investigations go to show that with sectional reductions of about nine per cent or less, the temperature range within which grain growth occurs on annealing lies approximately between 690 and 780 degrees Centigrade. Annealing above the higher temperature completely refines the grain.

On the other hand when the reduction of area is greater than about nine per cent the range of temperature within which grain growth occurs on annealing falls approximately between 650 and 900 degrees, a higher temperature than 900 degrees again resulting in complete refining.

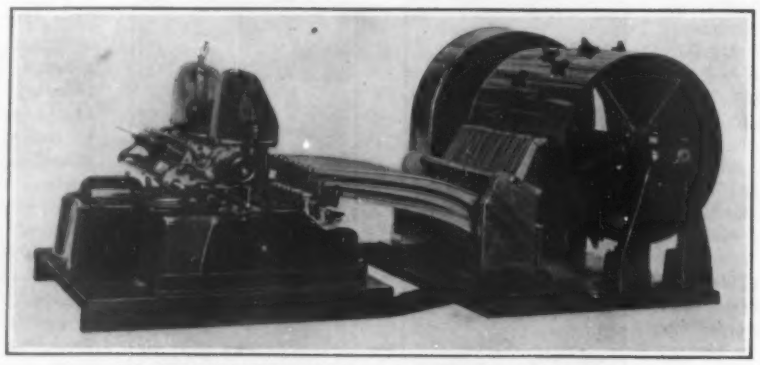
It follows from these observations that immunity from the development of crystallization can be secured by keeping the annealing temperature below 650 or in certain cases 690 degrees. This heat is for the most part sufficient to remove the effects of cold working, but sometimes a higher temperature is called for, and in such cases the furnace should be brought up to 900 degrees, although in certain cases annealing at 780 degrees will refine the grain sufficiently to prevent trouble. Grain growth occurs only in low-carbon steel, and if a steel can be used that has more than 0.15 per cent carbon content no growth need be feared. Where low-carbon steel must be used grain growth can be avoided by the use of comparatively heavy operations on the metal, or by proper selection and control of the annealing temperature according to working conditions. If the material is not annealed no grain growth can occur, but non-annealed cold worked steel is, of course, subject to weaknesses of other kinds.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Mechanical Exerciser for the Typewriter

THE machine which we illustrate herewith is employed in the testing room of the factory where a well-known typewriter is produced. When operated rapidly and continuously, the keys of a typewriter, if not hung with the most delicate precision, will stick and tangle and pile in a most distressing manner. And as a more exacting and uniform test than mere operation by an expert typist, this machine has been designed. It consists of a metal cylinder about a foot in diameter, which is revolved by a small electric motor. On the surface of the cylinder are teeth set at such intervals that they successively strike a series of hammers, delicately balanced and tipped with rubber. These mechanical fingers are arranged in three tiers and there is one for each character on the keyboard. It is fascinating to see this device in operation as the levers rise and fall almost faster than the eye can follow them, yet each one strikes its letter accurately and produces a perfect impression. The testing machine develops a speed of 800 strokes per minute, and while this is half again as fast as the best short-distance record by a human operator, it is plain that in striking as many as 500 keys per minute there must be brief intervals in which the operator attains a speed approximately that of the testing machine. Accordingly the test is not an unduly severe one, and if the typewriter fails to pass it with flying colors, back it goes to the assembling room.

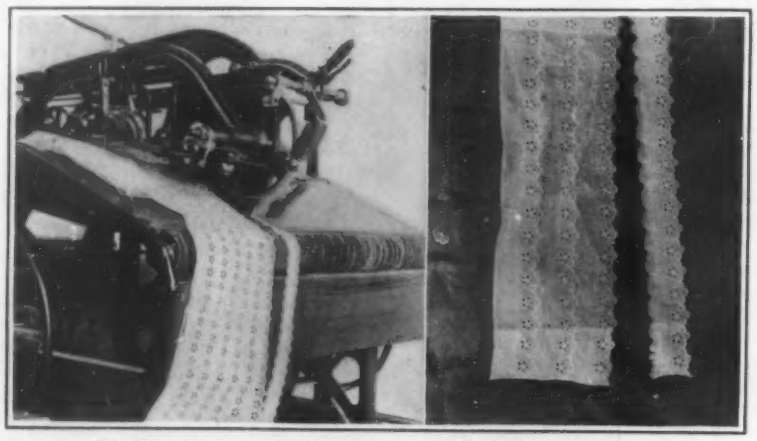


Mechanical tester putting a typewriter through its paces

A Scollop Cutting Machine

MACHINES for making embroidery have been in use for many years, but the work of separating the embroidered strips from the material upon which the fanciful designs have been made so they could be used has been done by hand labor. A machine has now been invented by Karl Keller of Arbon, Switzerland, to do away with hand cutting; one machine with a capacity of 12,000 yards per day can readily be made to do as much of this kind of work as fifty hand cutters now do.

The fabric in various lengths and widths is drawn into this machine by means of a belt 8 feet long running over two pulleys, the underside of the belt coming in contact with the upper surface of a large wheel under the baseboard. To accommodate this latter wheel the baseboard is made curving. The cloth coming in contact with the underside of the belt and the top surface of the large wheel is drawn against the knife which is half an inch wide and 36 inches long. The embroidered figure or design is drawn over the cutting edge while the cloth to be cut is forced against the under edge of the knife. The principle involved is very much similar to that by which a razor is enabled to cut the beard and glide harmlessly over the flesh. No design or embroidered fabric is too intricate for this machine to cut or separate from the material to which it is attached. As the strips are cut off they are reeled upon cartons ready for sale. It is confidently expected by the inventor that this machine will bring about a revolutionary change of world-wide proportions in the industry.



Machine for cutting scallops, and a sample of the work it does

A Motion-Picture Projector that is Different

SOME twenty years ago the SCIENTIFIC AMERICAN described and illustrated a machine invented by C. Francis Jenkins of Washington, D. C., which recorded and reproduced motion. This machine, acquired soon after by the National Museum, was the original of the type which has become universal the world over.

Mr. Jenkins has recently brought out a new machine, which, while embodying the essentials of the old machine, contains also certain new features which make it particularly acceptable in school work.

Perhaps the first feature to attract attention is the absence of an upper film reel magazine. Both the full reel and the take-up reel are placed in the large octagonal cast iron magazine, located below any possible source of fire. From this single magazine the film passes upward between fire quenching rollers, past the upper sprocket, thence down past the light aperture and over the lower sprocket, continuing on down through other fire-trapping rollers into the magazine again, where it is received by a take-up reel.

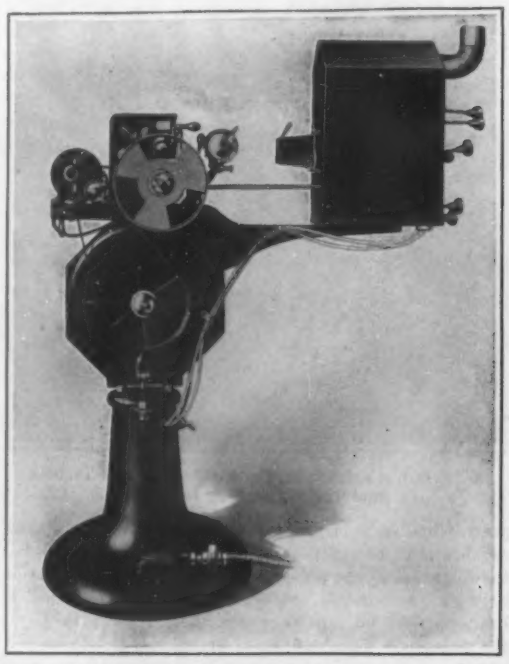
The powerful rays of light from the lantern, after passing through the film at the aperture, are bent at right angles by means of a prism and pass on through the lens to the screen. Between the lens and the screen the light is interrupted by the usual three-blade shutter.

A unique feature, too, is the triangular link employed in the new machine to eliminate the train of gears generally used to connect the upper and lower sprockets and to synchronize the operation of these and other essential parts of the film handling mechanism. Still another feature of interest is the "framing" lever which brings the film image into register on the screen, so that there shall be one picture showing at a time. This is accomplished in this instance by moving the optical system only. On first thought this would seem to make the light square sweep up and down on the screen, but as a matter of fact it does not because of the right angle projection.

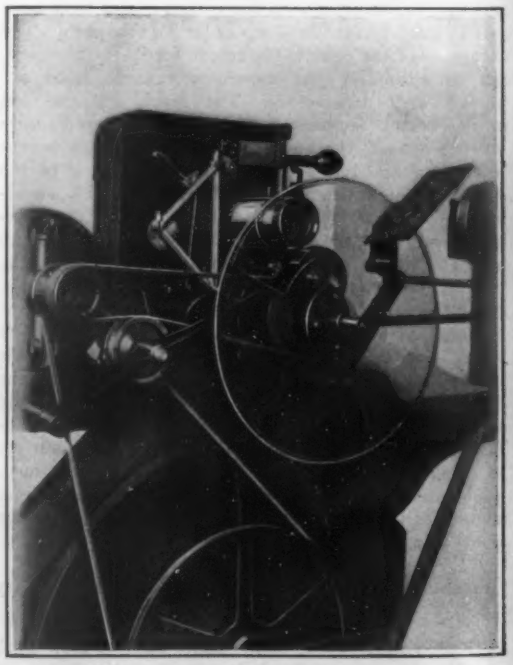
With a machine having the entire film enclosed in a cast iron magazine located below any possible source of fire, with the exception of a few inches actually being projected, the present projector seems to have been carried to a point as near perfection as the motion picture engineers can go in providing safety in this new art. And in connection with this machine it is interesting to record the progressive action recently taken by Fire Marshal P. W. Nicholson of the Washington Fire Department and Capt. Lester L. Kingsbury, Chief Electrical Inspector of the City of Baltimore, in requiring that all temporary installations of motion picture machines approved therefor shall be operated in the open, insuring the safe handling of the film when not in actual use in the projecting machine. It is such an obviously logical and sensible action, this putting a public watch on the operator to see that he

(Concluded on page 136)

The film moving mechanism or "head" of the new projector, showing the prism of the odd optical system employed



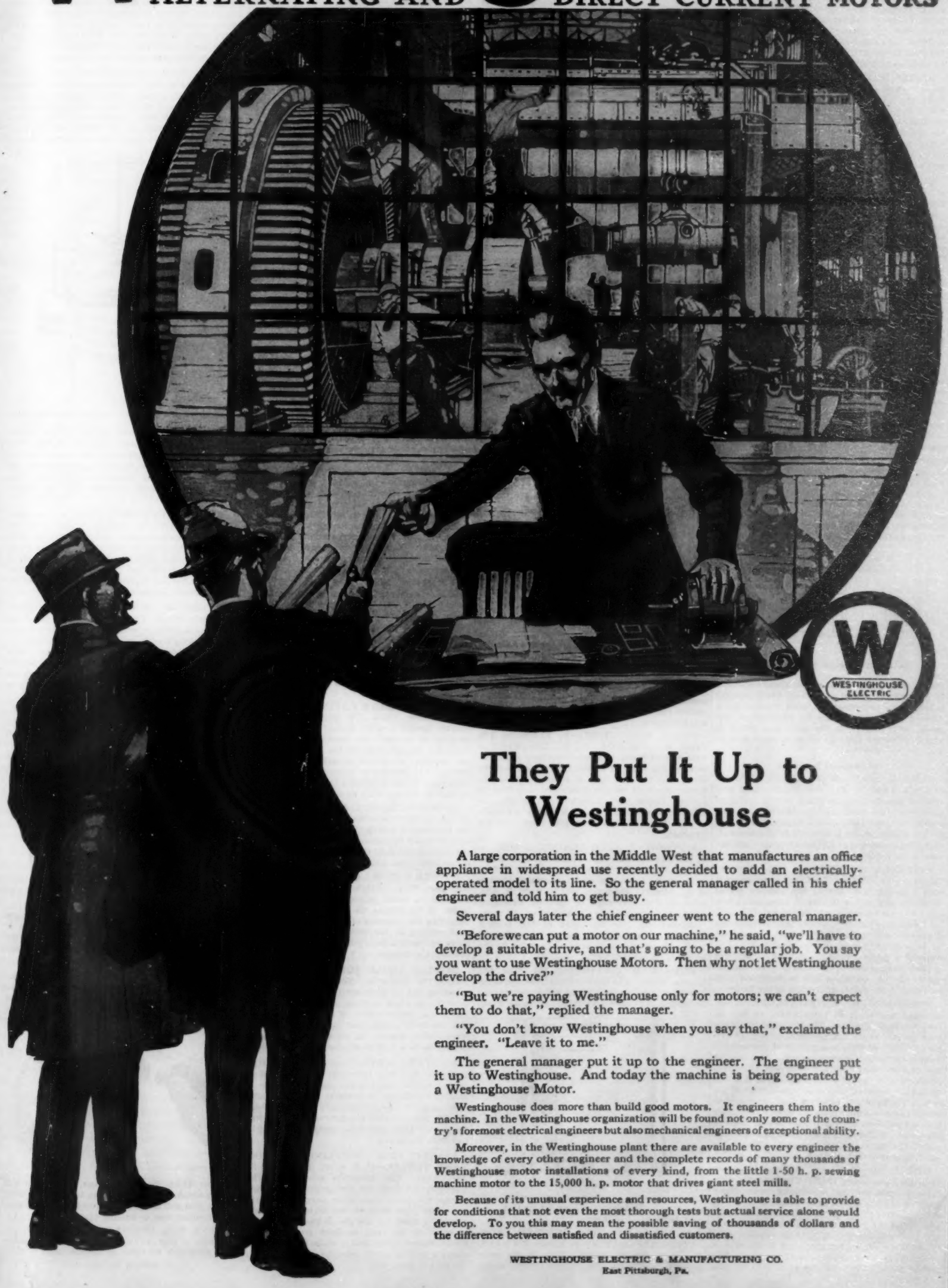
A motion-picture projector which has only one film magazine and projects the pictures at right angles to the film



The lens and shutter of the projector. Note the triangular link, which serves to eliminate the usual train of gears

Westinghouse

ALTERNATING AND DIRECT CURRENT MOTORS



They Put It Up to Westinghouse

A large corporation in the Middle West that manufactures an office appliance in widespread use recently decided to add an electrically-operated model to its line. So the general manager called in his chief engineer and told him to get busy.

Several days later the chief engineer went to the general manager.

"Before we can put a motor on our machine," he said, "we'll have to develop a suitable drive, and that's going to be a regular job. You say you want to use Westinghouse Motors. Then why not let Westinghouse develop the drive?"

"But we're paying Westinghouse only for motors; we can't expect them to do that," replied the manager.

"You don't know Westinghouse when you say that," exclaimed the engineer. "Leave it to me."

The general manager put it up to the engineer. The engineer put it up to Westinghouse. And today the machine is being operated by a Westinghouse Motor.

Westinghouse does more than build good motors. It engineers them into the machine. In the Westinghouse organization will be found not only some of the country's foremost electrical engineers but also mechanical engineers of exceptional ability.

Moreover, in the Westinghouse plant there are available to every engineer the knowledge of every other engineer and the complete records of many thousands of Westinghouse motor installations of every kind, from the little 1-50 h. p. sewing machine motor to the 15,000 h. p. motor that drives giant steel mills.

Because of its unusual experience and resources, Westinghouse is able to provide for conditions that not even the most thorough tests but actual service alone would develop. To you this may mean the possible saving of thousands of dollars and the difference between satisfied and dissatisfied customers.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
East Pittsburgh, Pa.

RECENTLY PATENTED INVENTIONS

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Pertaining to Apparel

STEAMING AND SMOOTHING DEVICE.—W. S. MAY, Lankersheim Hotel, San Francisco, Cal. This device may be readily attached to the radiator to receive steam therefrom, to permit a necktie or other article to be effectively steamed and then smoothed and dried by the heat remaining in the device after steam has been cut off from the latter, the arrangement being more specially intended for office radiators where the owners of the articles may themselves utilize the device without having recourse to professional renovators.

SPRING DRESS FASTENING.—W. MILLER, 43 St. Oswald's road, Small Heath, Birmingham, England. The invention provides a fastening which is not liable to injury in such laundry operations as mangling and ironing. It comprises the use as one element of the fastening of a flat spring metal ring which can be detachably engaged by a projection from the complementary part of the fastening.

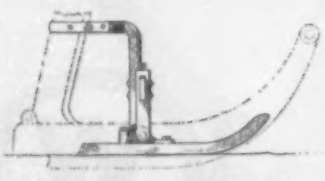
SHOE LACE CLASP OR FASTENER.—H. MARKIEWISH, Park Ridge, N. J. This invention relates to clasps or fasteners especially adapted for holding the ends of a shoe lacing without the necessity of tying the ends into a bow or knot. The clasp is so designed that it can be easily and quickly applied or removed from the shoe lacing. It is not necessarily limited to the use for lacings on shoes.

HAIR PIN.—E. E. TAYLOR, 1126 S. 4th St., St. Louis, Mo. The invention in this case provides a device which will not be accidentally dislodged, which may be readily withdrawn, and which will not injure the hair. As no barbs or equivalent are presented to the hair the pin prevents any injury.

Interest to Farmers

PNEUMATIC CONVEYER.—J. A. WORSHAM, Marcs, Ill. This invention relates to pneumatic conveyers intended to feed granular material. It provides a conveyer characterized by the provision of a baffle-plate at the inlet of the granular material into the air passage, which baffle-plate extends beyond the inlet for the material.

GAGE ATTACHMENT FOR PLANTERS.—B. F. GREIMANN, Garner, Iowa. The invention provides gages which do not interfere with the shoe of the planter, wherein runners are so shaped that they will ride over or guide away all rubbish with which they contact, which allows the runners to be set close to or far from the shoe according to the character of the soil, which insures



GAGE ATTACHMENT FOR PLANTERS

that the runner will move straight ahead regardless of their distance from the shoe, which permits independent movement of each runner in a vertical plane, which may be adjusted to any height with respect to the shoe, and which is adaptable to the different types of shoes now in use.

Of General Interest

SAMPLE CARD.—H. MACCANLIS, 13 White St., New York, N. Y. This improvement provides a sample card provided with a series of sample-carrying tabs, any one of which may be readily removed and replaced by another in case the particular pattern is sold out or discontinued, thereby maintaining at all times a proper appearance of the sample card.

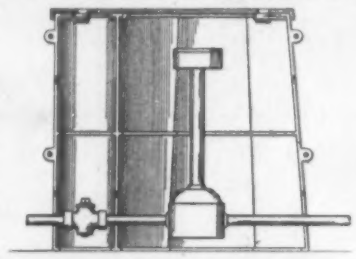
DISTANCE FINDER.—A. W. CHURCH, Jefferson City, Mont. The finder is constructed with a hollow body having two sighting places which the user may with his eye, bring into alinement with the base of the object, substantially on a level with the user's feet, when a pendulum having distances marked thereon, will swing to a point where a distance mark on the pendulum will be disposed adjacent a mark on the body which will indicate the distance of the object. The distance marks on the pendulum will be indicated with reference to the height of the user of the finder.

STEREOSCOPIC CINEMATOGRAPH.—J. RICHARD and L. J. E. COLARDEAU, 13 Rue de Navarin, Paris, France. The invention comprises an arrangement on a single band or film, of two parallel rows of right and left hand stereoscopic images corresponding each to each. This band is moved horizontally past stereoscopic objectives provided with optical arrangements, the function of which is to bring the two images in front of the eyes. The band can, in this manner, be caused to pass a series of similar pairs of objectives, in order that several observers can simultaneously observe the views. If the band is advanced at a sufficient speed, the views, which appear in stereoscopic relief, appear to be animated.

CHUTE.—R. W. BAILY. Address, Interstate Mfg. Co., Oskaloosa, Iowa. The invention provides a substantially rectangular open frame adapted to form a passage or to line or frame an opening through a wall, and having a door for permitting the frame to be closed when desired, and having protecting wings at the opposite sides of the frame for preventing injury to the wall of the building, from the impact of fuel or the like passed through the frame; the said wings being so arranged that they may be moved inward into operative or outward into protecting position.

PROCESS WHEREBY A VALUABLE AND NUTRITIOUS EXTRACT IS PRODUCED FROM FISH AND OTHER AQUATIC ANIMALS.—W. V. COONS and B. HEWITT. Address, Barnard, Robertson, Heisterman & Tait, B. C. Permanent Loan Bldg., Victoria, Canada. This process first removes a great portion of the albumin by cold water in which it is soluble, so that when fresh water is applied and the mixture heated, the heated water will pass readily through the material and release the extractives. It is not necessary to boil the material so in consequence the liquid, when drawn off, does not contain such a quantity of gelatin, and other impurities, as would be the case if the material was boiled. The cold liquid first drawn off is then used for cleaning the second liquid of impurities.

WATER METER BOX.—J. F. O'CONNOR, 1003 W. Hays St., El Reno, Okla. This invention has particular reference to a new form of casing for inclosing either a water meter alone or a water meter in connection with an adjacent cut-off



WATER METER BOX

valve for the water. Among other features of novelty is the improved form of locking cover for the casing, the tool for locking the cover serving also as a lifting handle when the cover is unlocked.

PROCESS OF PRODUCING ATTRITION SHEETS AND THE ARTICLES OF MANUFACTURE PRODUCED THEREBY.—H. F. STEMPEL, JR., Address, Henninghausen & Henninghausen, Attys., Fort Madison, Iowa. An object here is to provide a process for making attrition sheets, disks, strips and other attrition devices which is simple and which results in a superior product. Further to provide for the manufacture of attrition sheets, disks and other attrition devices which obviates the use of heat and pressure.

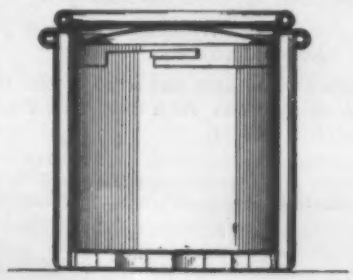
APPARATUS FOR PURIFYING INDUSTRIAL OILS AND FATS.—L. J. NOËL, 18 Rue du Moulin à Vent, Epernay, Marne, France. This invention provides an apparatus for purifying oils, fats and greases which have been used in workshops and factories either for lubricating machinery or parts of machinery or for other purposes and in the course of which use all kinds of impurities have become incorporated in these oils, fats and greases.

COMBINED PERCH AND TRAP.—W. MACK, 2193 Broadway, New York, N. Y. This invention provides a perch and trap for use in bird cages, chicken coops, and other apparatus and arranged to provide a convenient perch for the bird to rest and to provide dark breeding chambers for lice and other mites to pass into from the bird while the latter is at rest on the perch, and which breeding chambers can be readily removed and cleaned periodically of the trapped mites.

STRAP STRETCHER.—A. ROBINSON, 149 Canal St., New York, N. Y. This invention relates particularly to strap stretchers employed beneath the seats of upholstered chairs, settees, sofas, and the like, and is adapted for use in connection with clamps shown and described in Letters Patent No. 1,188,206. It is just as valuable where other clamping means are used, or even tacks or screws, and uses other than for furniture.

METHOD OF SAND BLAST CARVING.—F. H. SCANTLEBURY, 233 Broadway, New York, N. Y. In carrying out this method the surface to be carved is covered with a gelatinous coating of an adhesive character, which, when it sets, presents a compressible or yielding substance substantially immune to the sand blast, due to its compressibility, for any part of the coating attacked by the impact of the sand particles will yield and prevent the wear of said coating by the action of the sand blast.

CUP.—F. B. CHESBROUGH, 141 Milk St., Boston, Mass. The object of this invention is the provision of an inexpensive cup which may be used for selling hot coffee and other liquids on trains



CUP

and in other places, the cup being so constructed that it will keep the coffee or other liquid hot for a considerable period of time.

SOLUTION SPECIFIC GRAVITY REGULATING APPARATUS.—L. LOGAN, 229 Dwight St., New Haven., Conn. This improvement provides in apparatus embodying means responsive to the variations in the specific gravity of the product, and means for pneumatically, electromagnetically or otherwise operating valves or other devices for the purpose of automatically securing a product of the desired composition and density by regulating the supply of one or more or all of the component parts of which the solution is made.

CONE CLUTCH LINING.—W. ACHTMEYER, 29 Wall St., Middletown, Conn. The purpose of the invention is to provide a new and improved clutch or brake lining of a woven fabric material arranged to permit the use of a straight flat piece of fabric material subsequently shrunk to the conical face of the clutch to assume the shape thereof.

ARTIFICIAL BUILDING MATERIAL AND METHOD FOR PRODUCING THE SAME.—LUDWIG KERN, Hamburg, Germany. This invention provides an artificial brick or like building material and method for producing the same, the brick having the desired strength of compression, is sound and fire proof, exceedingly light and porous and capable of being sawed, drilled and nailed in place, thus rendering the brick exceedingly serviceable for use in partition walls and other interior structures.

PROCESS FOR PRODUCING ARTICLES FROM DIATOMACEOUS EARTH.—LUDWIG KERN, Hamburg, Germany. This process makes diatomaceous earth moldable without the use of clay, for producing various articles such, for instance, as are used for filtering or purifying liquids and gases, diaphragms for use in electrochemistry for the separation of the anode and cathode spaces, fire bricks in use in kilns, smelting and other furnaces, as insulating material for electricity, heat, sound and fire, or for building or other purposes.

KILN OR OVEN.—LUDWIG KERN, Hamburg, Germany. The kiln or oven is more especially designed for burning bricks, formed of a mixture of infusorial earth and clay, and arranged to permit of first passing a current of air over the green bricks to reduce the moisture thereof, to then subject the bricks to heat of 650 to 950 centigrade to burn or harden the bricks, and to finally pass another current of air over the burned bricks to quickly cool the same.

METHOD OF MANUFACTURING ENVELOPES.—M. VIERENGEL, 604 Van Buren St., Brooklyn, N. Y. The invention consists in cutting a continuous paper blank so as to provide gummed seams at the edges thereof; in moving the continuous blank past an operating station where a reinforcing member is added thereto prior to severing the sections of the blank which form the ultimate product; in delivering metal clasping members to the blank; in punching an oric infie the blank and in the reinforcing section thereof for registry; and in gumming, severing, and folding each section to form a completed envelope, the flap whereof is shaped to register the orifice therein with the clasp in the body of the envelope.

CARRYING LOOP FOR FOLDING UMBRELLAS.—MARY J. COLEMAN, 206 Broadway, New York, N. Y. This improvement provides means for carrying an umbrella without encumbering the hands of the user; holds the handle of a folding umbrella in juxaposed relation to the rolled fabric of the umbrella when in folded position; provides means for carrying folded umbrellas when in the folded position; and provides additional loops for constricting the folded fabric of the umbrellas.

PORTABLE DARK CABINET.—G. LEACHMAN, Sebring, Ohio. The inventor provides a cabinet having a table around which a flexible member is secured, the flexible member being normally supported above the table and having two openings which are normally closed by ruby glass. It is possible to substitute plates for the ruby glass, in one of which a lens may be mounted so that the cabinet may be used as a camera.

SACK BALER.—R. L. EDWARDS, Asher, Okla. In this instance the invention has for its purpose the provision of a device for compressing a bundle of sacks into a tight compact mass, and for holding the sacks in this tight compact mass until securing means have been connected with the bale.

BOTTLE VALVE.—C. F. LENG, 42 Broadway, New York, N. Y. This invention provides a valve arranged to insure proper working of the valve under all conditions, to permit of conveniently decanting the contents of the bottle, and to prevent refilling of the bottle with spurious goods either by use of a force pump or like device, or by the use of a vacuum.

DISPLAY SHELF SUPPORT.—H. J. NUTRIZIO, 145 Duane St., New York, N. Y. This invention has for its general objects to provide a store fixture which is of comparatively simple and inexpensive construction, of durable, substantial and attractive design, and capable of supporting considerable weight. It relates to supports for display shelves, such as are used in store windows.

SANITARY SCREEN.—G. A. SLEIGHT, Hyde Park, N. Y. This invention provides a disinfectant holder beneath the pan, the means for holding said holder in position, the pan arrangement partially over and partially under the nosing of the urinal to permit the removal of matter from the pan, and the means for ready removal of the pan from the urinal.

SAFETY FUSE COUPLING FOR GAS TANK VALVES.—O. S. KING, 218 E. 42d St., New York. The invention refers to devices especially adapted for use in connection with valves for tanks containing oxygen and other gas under great pressure, the device operating to provide a relief for the gas in case the internal pressure of the tank becomes greater than a predetermined point, due to a rise in temperature above a critical point, whereby the explosion of the tank is prevented

Hardware and Tools

DOOR SCRIBER AND GAGE.—E. CEDERBERG, 17 Personette St., Caldwell, N. J. The invention relates to a tool for marking the irregularity of a door jamb on a door to be fitted, so that when the edges of the door are dressed to the marks so made by the tool the door will fit perfectly into the jamb. It provides a tool whereby the irregularity of a door jamb can be easily and quickly marked on the door to be fitted into the jamb.

RAKE.—H. G. KIMBER, 1633 25th Ave., Oakland, Cal. Mr. Kimber's invention pertains to a wire rake for garden and lawn purposes, and particularly to a rake head in which the wire tines spread in fan-like form from the handle end. The tines are so formed and arranged as to give the even, smooth drag so much to be desired.

NAVIGATOR'S DISTANCE AND BEARING TAKER.—E. Y. HASKELL, Yacht Viking, New London, Conn. This invention has particular reference to devices used particularly in connection with ships' binnacles for the purpose of observing distances and taking of bearings. It is an important improvement over the device

NAVIGATOR'S DISTANCE AND BEARING TAKER

shown in Letters Patent of the United States, issued to Mr. Haskell, No. 1,148,380. The present invention provides an attachment in connection with the bearing-taker whereby the number of miles to distant objects from either bow of the ship may be noted while the ship is running.

KEY LOCKING DEVICE.—M. B. PETERSEN, 222 Minor Ave., N. Seattle, Wash. This improved device includes a member adapted to be inserted in the keyhole beneath the stem or shank of the key and having a head provided with a co-acting movable and relatively fixed members to engage the bow or ring of the key and hold the same against turning or displacement.

RULER.—H. W. OLNEY, care of The Public Ellsworth Bldg., Chicago, Ill. The invention provides a device wherein a plate or strip is provided having a scale on one face and provided at the other face with means for supporting a strip of blotting paper in spaced relation with respect to the adjacent face of the plate, to permit the easy application of the blotter to the surface to be blotted.

ADJUSTABLY LOCKED FASTENER.—F. W. PIERPONT, 41 Oak Park Road, Asheville, N. C. This fastener is of the nature which extends through articles to be connected, without screw or other engagement with the articles except by clamping contact with the outer faces thereof,

ADJUSTABLY LOCKED FASTENER

the primary object being to provide a fastener including relatively adjustable members, one of which is provided with means engageable with the other, whereby the two members may after adjustment, be locked against displacement.

SNAP.—B. B. WOOD, 410 S. Mills St., Madison, Wis. This invention provides a snap in which the latches with which the removable segment or member interlocks, are reinforced against undue strain or disruptment by the walls of the casing

SNAP

against which the latches bear. The snap will safely retain the separable number or segment in place, and will not become unlocked by accidentally rubbing over or striking obstructions.

LINK FOR SPRINKLER HEADS.—L. A. GRIMES, 97 Day St., Orange, N. J. The invention has particular reference to tension links to hold

(Concluded on page 134)

A Vegetable Partnership

(*Concluded from page 125*)

ments of rock, which, added to the organic matter from decayed lichens, is the first step in soil formation. Who knows but that a similar process was responsible for much of the early soil formed upon this earth?

The use of lichens as sources of dye is of long standing. The famous blue and purple dyes of the East, so frequently mentioned in history, were in all probability extracted from the Roccella lichen, which has in recent times been extensively used in France for the gorgeous coloration of silks. Lichen dyes are secured by pulverizing the plant body, termed the thallus, and applying alkali to extract the coloring matter. One lichen dye, litmus, finds wide application in the science of chemistry.

The greatest economic importance, however, of this strange group of plants is, perhaps, that suggested by Dr. Jacobj, namely, their value as a source of food for both man and beast. The reindeer moss, (*Cladonia rangiferina*) is well known as the main source of sustenance for the reindeer and caribou of our northern regions. During the winter it is the only food supply of these animals, who need only to poke their noses through the snow or scrape it away with their antlers in order to get a nutritious meal. Great browsing fields of reindeer moss exist in many parts of the Arctic region, and are used alike by the wild reindeer and the domestic herds of the Laplander. It is this plant which is proposed by Dr. Jacobj as the main source of fodder. It could probably be similarly utilized in this country, as the writer has personally seen great masses of this lichen growing along the shores of Lake Superior, and large crops undoubtedly exist in other parts of the United States. In northern Minnesota, patches covering an acre or more of ground are not infrequent. According to Dr. Jacobj, reindeer moss when boiled in whey forms an excellent and nutritious fodder. Its food value is said to be three times as great as that of the potato. In former times reindeer moss was used in the production of sugar and alcohol and was also utilized by the people of Sweden as a flour for bread making.

For human consumption, Dr. Jacobj recommends the Iceland Moss (*Cetraria islandica*). Previous to the introduction of gelatin this plant was used in the preparation of jellies. Iceland moss in the raw state contains a bitter principle which may be removed by allowing the plant to stand in a one per cent solution of potash for about three hours. The bitterness passes entirely into the resulting extract, which is the stomach medicine previously mentioned. Thorough washing in water will serve the same purpose. The lichen is then dried, powdered, and mixed with an equal part of flour. The resulting compound is said to be an excellent flour for bread-making. In our northern regions, the flour made from the Iceland Moss is used for making not only bread, but also pancakes, which are said to be excellent.

With increased knowledge of the growth of lichens, perhaps, these suggestions coming from Germany may find ready application in the United States, and the lichen farmer may not be an impossibility of the future. It is even possible that waste lands in some parts of the country may be utilized in the growth of lichens, if they are found to be of the practical importance suggested in the works of Dr. Jacobj.

Kapok for Explosives

SINCE the war, exportation of cotton is prohibited in France, because all the available supplies are needed for the manufacture of explosives, and it is now found that the substance known as kapok, which has already been described in our columns, answers as a substitute for cotton. This fact was brought out by the chemist André Arnoux, who showed that kapok, treated in the same way as cotton, was at least equal to it for explosives. He found an improved method of treating kapok, which is not made public. Kapok is to be classed on the same basis as cotton, and garments wadded with it must not be sent to prisoners of war in Germany.

NEW-YORK LIFE

INSURANCE COMPANY

346 & 348 BROADWAY . . . NEW YORK CITY

TO THE POLICY-HOLDERS AND THE PUBLIC:

A brief of the chief activities of this Company during 1916 runs as follows:

New Paid Business $263,048,300.00

Of this total $239,090,873 was secured in the United States.

Total Income $138,559,395.79

From New Premiums	$10,241,497.43
From Renewal Premiums	$82,843,015.14
From Interest and Rents	$38,108,768.16
From miscellaneous sources (exclusive of increase in Book Value of Assets)	$7,366,115.06

Total Payments to Policy-holders . $81,415,138.36

In Death Losses	$29,332,346.32
In Endowments	$11,384,424.69
In Dividends	$19,695,355.33
In Surrender Values	$19,551,361.00
In Annuities	$1,414,154.02
In Disability Claims	$37,497.00

Significant Facts:

Mortality Rate reduced
Expense Rate reduced
Interest Rate increased
New Business increased

Invested During the Year in Bonds and Mortgage Loans . . . $70,717,602.17

To pay 5.26%.

Added to Legal Reserves	$24,676,393.00
Market Value of Assets, Dec. 31, 1916	$866,988,841.57
Legal Liabilities	$728,226,426.34
Reserved for Dividends and Contingencies	$138,762,415.23
Outstanding Insurance	$2,511,607,274.00

Represented by 1,228,601 policies.

The actual mortality of the Company expressed in the per cent. which it bears to the expected death losses according to the tables of mortality adopted by the State for valuation purposes through a period of years is as follows:

1912 Actual death losses 76% of the "expected"
1913 Actual death losses 73% of the "expected"
1914 Actual death losses 73% of the "expected" (5 mos. of war)
1915 Actual death losses 73% of the "expected" (12 mos. of war)
1916 Actual death losses 71% of the "expected" (12 mos. of war)

The Seventy-Second Annual Statement of the Company will be filed at once with the Department of Commerce in Washington and with each State of the United States and each country where we do business. A brief of that statement will be sent gratis to any person asking for it.

DARWIN P. KINGSLEY,
President

RECENTLY PATENTED INVENTIONS

(Concluded from page 132)

the compression members from collapsing under normal pressure. The primary object is to increase the efficiency and reliability of links of this character, each link including a pair of duplicate plates normally held rigidly together by means of fusible metal.

RECOVERY MEANS FOR MACHINE-CONSTRUCTION DEVICES.—G. F. Lowe, 13 Ridgedale Ave., Morristown, N. J. This invention provides means for recovering articles to prevent the loss thereof; provides a recovery device of simple and inexpensive construction; and provides a recovery device which does not interfere with the operation of the element to which it is applied.

BALE BAND BUCKLE.—W. C. Ragsdale, P. O. Box 17, Weatherford, Tex. This improvement pertains more particularly to bale band buckles made from a single piece of bar material such as wire for securely fastening the ends of a bale band and provides a buckle which can be applied with great rapidity, can be cheaply manufactured, and will give the greatest strength possible with the amount of material used.

Heating and Lighting

HEATER.—L. L. Gore, 472 Central Ave., Marshfield, Ore. This invention provides a heater to transfer heat to the incoming medium from the medium passing out of the heater; provides a construction employing materials adapted for rapid radiation of the heat, and generally provides a heater wherein the material to be heated has transferred thereto the heat units contained in the products of combustion which otherwise would be lost.

Household Utilities

EGG BEATER.—A. Moses, 533 W. 151st St., New York, N. Y. Among the principal objects which the present invention has in view are: To facilitate the replacement of the loops of the beater; to hold separate loops of the beater rigid in service; and to simplify and to reduce the cost of construction of the beater.

IRONING BOARD, PAD, AND COVER.—R. Poll, care of Ringer, Wilhartz, Louer and Concannon, Fort Dearborn Bank Bldg., Chicago, Ill. This invention provides a pad and cover for an ironing board or table, either as separate articles of manufacture, or as a unit, adapted to ready connection with the board or table without the necessity for sewing, lacing, pinning, or nailing the pad and cover to the board or table, special holding means being provided on the board or table for said pad or cover.

SASH PULLEY.—C. D. Shupp, Nehawka, Neb. An object of the invention is to provide a sash pulley which can be securely fastened to the window frame, without mortising or countersinking, by means of which, orifices giving rise to drafts can be eliminated, and which can be used with equal facility with mortised top and flat top window frames.

SELF-CLOSING PENDULUM HANGER FOR DOORS.—J. H. Stewart, 503 Clinton Ave., Jamaica, L. I., N. Y. The invention relates to self-closing doors, particularly, although not necessarily, adapted to elevator shafts, whereby the door will automatically close as soon as the conductor in the elevator car releases the door. The construction and operation are so designed as to permit the door to be easily opened.

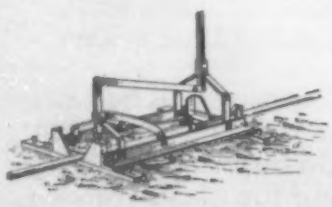
BURGLAR ALARM.—D. Cruice, 309 W. 117th St., New York, N. Y. The inventor provides a portable device adapted for disposition in operative relation to a door, window or other movable member; provides a structure having resonant qualities to augment the sound of the detonation; and provides a structure which is simple, inexpensive and durable.

BROOM.—H. J. Edlund, 368 South Union St., Burlington, Vt. This invention relates to a construction which utilizes a minimum amount of broom corn or other similar material. It provides a broom with a rigid socket, part of the socket firmly clasping the broom corn and part acting as a bracing member for causing the free ends of the broom corn to bow in a comparatively wide circle.

Machines and Mechanical Devices

CASH REGISTER.—C. E. Clifford, Albany, Ore. The main object here is to provide a register within a purse or pocket-book of any desired type whereby the owner may at all times be able to see the difference between incoming and outgoing cash, the device being of particular value to photographers, blacksmiths, and others who handle relatively small and varying amounts of cash.

PIPE PUSHING AND PULLING MACHINE.—H. A. Brown, 614 N. Court St., Ottumwa, Iowa. This invention has for its object the provision of a machine, by means of which, pipes as, for instance, gas and water pipes,



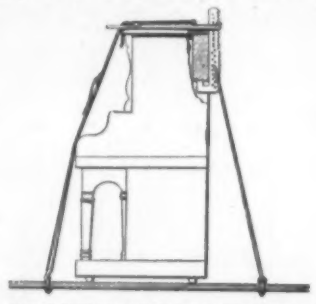
PIPE PUSHING AND PULLING MACHINE

telephone conduits and the like may be pushed through the ground or pulled therefrom, and wherein means is provided in connection with the machine for guiding the pipe and holding it in proper position.

BOAT PROPELLER.—C. E. Chaves and F. G. Sanchez, 517 Bahaha St., Key West, Fla. This invention provides means for propelling a boat having a stern propeller shaft, and side propellers mounted on a transverse shaft, these being means for operating the two shafts from a transverse shaft having a crank at each end to which arms on the operating handle are articulated.

SAW FILING MACHINE.—H. I. Hanson, Lock Box, No. 1, Summit, S. D. The improvement provides a machine having an improved vise or saw clamp for holding the saw against vibration. It provides means for feeding the carriage along the supporting frame automatically, and provides means for automatically adjusting the device to acquire the proper depth of cut.

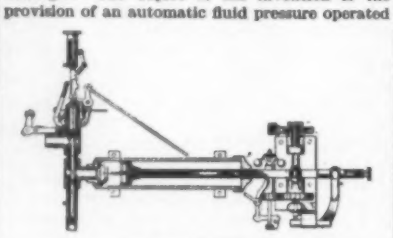
ANCHORING MEANS FOR HEAVY ARTICLES.—F. S. Sammel, Bedford, Pa. Mr. Sammel's invention is an improvement in anchoring means for heavy articles., as for instance pianos, automobiles, packing cases, and the like,



ANCHORING MEANS FOR HEAVY ARTICLES

wherein mechanism is provided capable of adjustment to bodies of various size for firmly anchoring said bodies to the floor of a car or the like, to prevent movement of the same during transportation.

PNEUMATIC TYPEWRITER CARRIAGE.—G. E. Callaway. Address, Dr. R. R. Beaswell, Jenkins Bldg., Mansfield, La. This invention is an improvement in pneumatic typewriter carriages. The object of the invention is the provision of an automatic fluid pressure operated



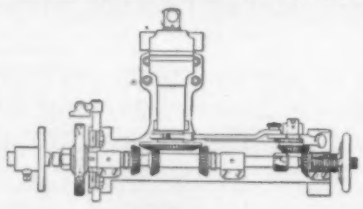
PNEUMATIC TYPEWRITER CARRIAGE

means for returning the carriage quickly when it reaches the end of its movement in one direction, and also to provide means for cushioning the return of the carriage. The accompanying engraving shows a vertical section of the improvement.

PAINTING MACHINE.—M. Ferber, 8019 17th St., Bath Beach, Brooklyn, N. Y. This invention relates to painting machines of the type having a force feed and a revoluble member adapted to either clear the surface to be painted or apply the paint thereto. It provides a simple and efficient machine particularly adaptable for cleaning and painting ships.

PRINTING MACHINE FOR CODE COMMUNICATION.—H. M. Ball, Jr., Livia, Ky. In the present patent the invention has reference to printing machines of a kind especially adapted for printing characters used in cipher code for the purpose of concealing the meaning of the message written, and also in many instances, for abbreviating such messages.

COMBINATION MACHINE.—J. Syvret, Box 2266 Sydney, New South Wales, Australia. The inventor provides a construction which may be adjusted or set so as to be used as a vise or as a turning machine. The machine is provided with a tool receiving shaft and means for driving the

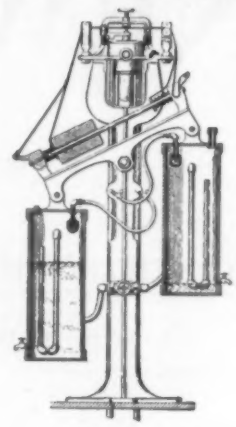


COMBINATION MACHINE

same which may be adjusted so as to be operated by hand power or by mechanical power. It may be used for grinding or for driving a drill, the parts being adjustable so as to rotate the grinding instrument in one direction when the same is used and to rotate the drill in the opposite direction and at different speeds as may be desired.

COPY HOLDER ATTACHMENT FOR TYPEWRITERS.—W. E. Gray. Address Bartels, Blood & Bancroft, Atty's, 728-735 A. C. Foster Bldg., Denver, Colo. This invention relates to copy holder attachments for typewriters and the aim is to improve such devices in a structural way, particularly a copy holder of the general type described in Mr. Gray's Patents, No. 1,183,639, and No. 1,144,190, from which it differs in certain features, among others the particular connections adjacent the line spacing lever of the typewriter, those connections between the line indicating bar and its shifting mechanism, and the structure of the shifting mechanism itself

PUMP.—G. Dorffel, 2316 E. 27th St., Oakland, Cal. This invention relates to an arrangement of pump which elevates water or other liquid through the use of compressed air. It provides a new construction and arrangement of



PUMP

parts in a pump which will utilize compressed air as a motive power in such a way that the pump will be automatically operated continuously as long as the water is permitted to flow or the air turned on.

Musical Devices

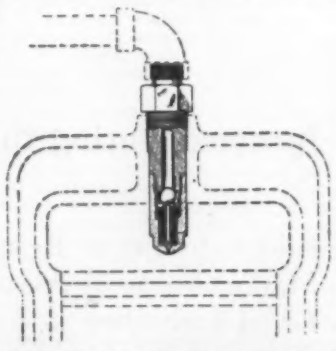
AUTOMATIC STOP FOR TALKING MACHINES.—C. H. Murphy, Point Pleasant, N. J. This device is adapted to be applied to any well-known type of talking machine wherein the movement of the sound box, in traversing the record groove, will automatically trip a mechanism to operate a brake member for bringing the turntable to rest, said mechanism having associated therewith a device for adjusting the same to a position where the operation thereof will be effected at a predetermined point.

UNIVERSAL TONE ARM.—L. Markels, Care of Sykes, McCole & Potter, 170 Broadway, New York, N. Y. This improvement refers to a tone arm for phonographs of the disk type and has to deal more particularly with an arm of that class which is provided with a reproducer holder, whereby the reproducer can be set for operating on disk records having a laterally waved groove or a vertically waved groove.

TALKING MACHINE NEEDLE MAGAZINE.—Mabel Blackman, 146 W. 65th St., New York, N. Y. This invention provides means for carrying a number of needles for use on talking machines, and to regulate the delivery thereof; and provides a simple device which may be employed as an attachment to sound boxes of conventional construction for talking machines.

Prime Movers and Their Accessories

VALVE FOR FUEL NOZZLES OF INTERNAL COMBUSTION ENGINES.—B. B. Mong, 1605 Pierce St., Muncie, Ind. The prime object here is to provide a nozzle having valve means



VALVE FOR FUEL NOZZLES OF I. C. ENGINES

controlling the fuel feed whereby to insure the admission to the cylinder of a predetermined amount of fuel and the prompt and unfailing closure of the valve absolutely tight after the admission of the predetermined charge, whereby to obtain a more regular operation of the engine than usual with the nozzles ordinarily employed.

STARTING APPARATUS FOR INTERNAL COMBUSTION ENGINES.—W. F. Clark, care of Baltimore Hotel, Los Angeles, Cal. This improvement comprises a motor, preferably of the spring-actuated type, for giving the initial impulse to the crank-shaft. Suitable clutching mechanism is provided to connect the crank-shaft to the motor; and means are included for automatically winding up the motor after the engine has commenced running, to put the spring under the required degree of tension, to set the engine again in operation after the next stop is made.

Railways and Their Accessories

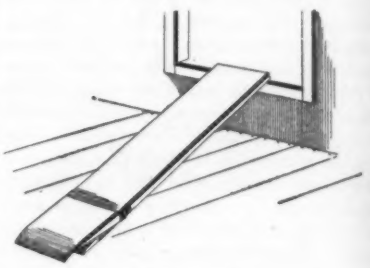
FREIGHT CAR ATTACHMENT.—D. H. Butts, 811 Morgan Ave., Norfolk, Va. The improvement pertains to means for the engagement of a door-opening bar whereby to exert leverage on a door in opening or closing the same. It provides coacting means on the door and on the the car for the proper engagement of the lever bar and for its effective action on the door without damaging either the car or the door.

AUTOMATIC TRAIN STOP.—J. B. Blackshear, 113 Hotel St., Honolulu, Hawaii. The improvement relates to automatic brake-applying means to be arranged in connection with the air-brake system of a train and including a spring-pressed plunger arranged to travel on a track rail and adapted, upon leaving the track, to open a relief valve in the train system for releasing the pressure, thereby automatically applying all the brakes on the train in case any car or truck should be derailed.

RAILROAD GATE.—W. Maxwell, 411 E. Emerson St., Bloomington, Ill. The object in this case is to provide a gate more especially designed for use on grade crossings and arranged to automatically sound an alarm and to subsequently close the normally open gates and hold the same closed by an approaching train until the latter has passed the crossing, and then automatically return the gates to normal open position.

RAILROAD GATE

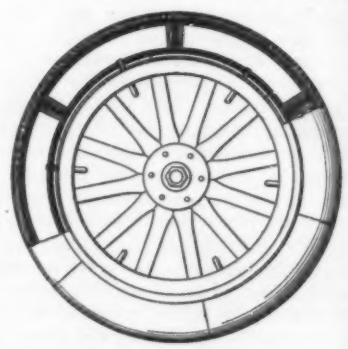
TRUCKING SKID.—E. A. Baker, Mayfield, Ga. The invention relates generally to trucking skids used to support trucks for conveying freight by hand from railway cars to depot platforms, from car to car, or from any particular place to another point where it is necessary to use a support for the truck in its movements, and has to do more particularly with skids utilized between two points, one of which is above the other and with means for preventing the skids so placed from slipping, without permanently attaching the same in position.



TRUCKING SKID

Pertaining to Vehicles

SECTIONAL VEHICLE TIRE.—G. Sheely Address Joseph H. Sheely, Howe, Ind. The invention replaces a worn out or injured section without disturbing more than the adjacent sections and without jacking up of the wheel on which the tire is used. To accomplish this, use



SECTIONAL VEHICLE TIRE

is made of a shoe or a casing, preferably made in two or more sections and adapted to be fastened to the rim of the vehicle wheel, sleeves fitting in the said shoe and inflatable inner segmental tubes each having closed ends and fitting into the corresponding ends of adjacent sleeves.

RESILIENT WHEEL.—R. W. Leeming, Brantford, Ontario, Canada. This invention provides a non-pneumatic resilient wheel. The main feature here consists in discarding compressed springs and substituting in their stead helical springs which are described as "neutral," that is to say, normally without compression or extension until acted upon by shock or weight of

RESILIENT WHEEL

vehicle. Compressed springs, it is claimed, are subject to mechanical difficulties fatal to their success. The questions involved are intricate, and too technical for notice here, but the neutral springs of this invention are said to overcome these difficulties and to provide a wheel possessing the resiliency of a pneumatic, without the obvious disadvantages.

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Industrial Preparedness for Peace

Agricultural Conservation

(Concluded from page 120)

beef or milk in a year, than will an acre of equal fertility in the corn country set in blue-grass. The South will become a great livestock country and the once despised Bermuda grass will be the foundation of the industry. It possesses the virtues of keeping the soil in place, of crowding out most weeds, of resisting drouth and overgrazing to a remarkable degree, and of lasting for an indefinite period of time. Adding these to its high yielding capacities, it becomes easy to see why the viewpoint toward it is changing. The fault of being hard to kill, serious enough in a cotton field, becomes a virtue in the pasture.

Another grass with a changing position in popular esteem is Johnson grass. Its fault is that of Bermuda grass. It spreads where it is not wanted and is hard to get rid of where it once establishes itself. Unlike Bermuda, it matures seed freely over most of its range and therefore spreads much more rapidly. In some states there are laws against sowing it. It grows just the same in those states, however, and there, as elsewhere, farmers have about quit fighting it and gone to utilizing it. It is a good pasture plant while it lasts, but pasturing soon reduces its vitality and enables other crops to be grown on the land—for a few years, at least, until cultivation has again given the scattered grass plants a chance to become vigorous and dispute possession with the things the farmer sows. It is a great hay crop, producing large yields, as valuable ton for ton as those of practically any of the meadow grasses. Johnson grass hay will almost surely be an increasingly important part of the nation's hay crop, and the plant itself will doubtless soon be distinctly out of the list of weeds and in that of valuable crops.

And so it goes. Automatically certain plants force the farmer, in self-defense, to find uses for them. As part of our agricultural conservation program, then, he should be rendered every possible aid in this direction. It is doubtless too much of a Utopian dream to look forward to a day when uses shall have been found for all of the botanical denizens of field and roadside, when there shall be no weeds at all and the members of the vegetable kingdom shall fall uniformly into the two categories of crops and wood flowers. But we can at least attempt a deliberate and scientifically worked out approximation to this state of affairs. To the farmer the possibilities thus opened up should possess extraordinary attraction. When he learns how to utilize to his profit the last apple from the last tree, he has come into possession of a new and valuable asset; but the man who will show him how to convert to good ends the goldenrod which is choking the hay in his best field, will not merely bestow upon him a brand new asset, but will at the same stroke relieve him of a serious liability of long standing.

Other items of interest might be mentioned; examples in support of each point might be multiplied; but it seems unnecessary to go any further. The point is inescapable; national prosperity and efficiency demand that, as a people, we utilize many of the things we have been and are now wasting. And to effect this end, we should put every resource at the disposal of the skilled technicians and the publicity experts, alike in the Departments of Agriculture and of Commerce and wherever else they can be found and put to work. When a single item which was once a total waste—cottonseed meal and oil—can show in a single year an export value of $40,000,000 and a domestic consumption far in excess of that figure, we may hardly venture an intelligent estimate of what might be saved by thorough organization of all our agricultural industries.

Manganese as Fertilizer

M. GREGORIO ROCASOLANO has made a series of researches on the action of manganese when used as a fertilizer, in which case its action is catalytic. The aim of the experiments was to observe the effect of manganese upon the process

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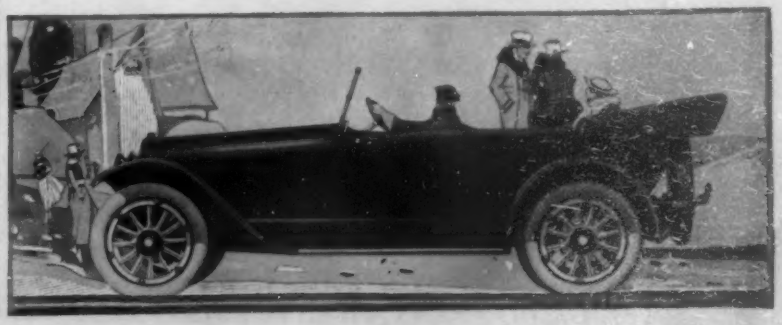

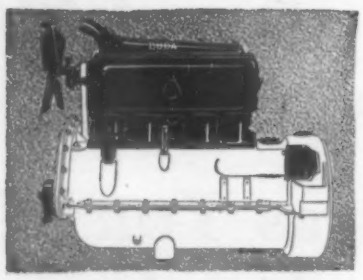

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of fixation of atmospheric nitrogen by microbes. His researches bring out that in practice the fertilizers which contain manganese stimulate the fixation of nitrogen in the plants and in the soil, when the catalyzing element does not exceed 6 milligrammes per 1,000 grammes of earth, but he finds that larger proportions diminish this action. Most soils contain greater amounts of manganese than this proportion, but the greater part is in insoluble form. Before making use of manganese as fertilizer in any given soil, it is important to determine the amount of this metal which appears in the state of soluble compounds, and to employ only the amount of the catalyzer which is required to reach the most favorable amount mentioned above.

Economic Conditions In Germany—III

Her Industrial Mobilization

(*Concluded from page 123*)

plant and to all outward appearances seemed to be on the best of terms with the men.

The mines of Belgium and the occupied French territory seemed to be all working as far as I could see from the roads. We stopped at a great number and others I am judging from the fact that the tipples were all running. I went down in the Bariemont Bascoup Mine in Charleroi and saw the famous women miners. These women wear trousers just like the men and can swing a pick or wield a shovel with equal speed. The Germans tried to put a stop to this practice of women working about the mines, but they found that many of the women and girls had no other occupation so they must be replaced by degrees to avoid the hardship that would be effected by their sudden removal. This is not allowed under the German labor laws. The women miners I saw seemed to be a husky, healthy lot and perfectly able to handle a day's work.

Germany will not suffer from lack of coal or iron; but she finds herself at a great loss in not having copper within her borders. To this end she has set about mobilizing whatever copper may be in her hands. The people were first called upon as a patriotic duty to bring in all old copper, tin, bronze or brass to certain designated central stations. The work was organized through the schools with competitions to see who could gather up the most per week. The school boys did nobly and gathered in thousands of tons of this useful metal. After the voluntary offerings of the public had been about exhausted a copper census was taken by the police. Each householder was required to fill out a form stating just how much of this metal he had in the house and in what form. This included door knobs, letter boxes, light fixtures, push plates, etc. Then the government set about replacing this with iron, for it is not possible to take these objects till there is something with which to replace them.

First went the oven doors. Every stove in Germany formerly had thick brass oven doors which the cook kept polished bright. These are of a standard size, easily replaced; the collector comes around, takes the brass oven door and leaves an iron one in its place. Next followed door knobs; and I suppose the collecting will go on as long the copper is needed. Lighting fixtures, being rather hard to replace, will probably be left till the last.

Germany's copper coinage has all been recalled and replaced by iron, and copper money has also disappeared out of Holland in mysterious fashion, for the price went up till a dollar's worth of Dutch pennies were worth more as copper than they were as pennies. The Dutch bargeman is a canny soul, so it is not strange that the barges and canal boats which go over the border into Germany equipped with copper pumps usually come back with wooden ones or none at all. One of the first moves Germany makes in occupying a conquered territory is to start collecting copper. The Russians finally realized this, and when they evacuated Warsaw they took church bells, telephone wires and copper boilers with them. There are certain old copper workings in Serbia which the Romans are said to have discovered. These the Germans have now cleaned out and are trying to find more of this precious metal there.

[*This is the last of Mr. Dawson's articles on Economic Conditions in Germany. The first article appeared in our issue of January 13th and dealt with Germany's prison problem. In last week's issue Mr. Dawson told of Germany's food problem.*—EDITOR.]

A Motion-Picture Projector that is Different

(*Concluded from page 130*)

complies with the regulations prohibiting smoking, and requiring that the film when not in use shall be kept in an approved metal container, that it is surprising the action was not taken long ago. Concealing the operator in a booth where he can disregard the regulations is an unnecessary increase in fire hazard. To make the operator work in the open is analogous to "putting a watch to watching a watchman." However, neither the Baltimore nor Washington, D.C., regulations have been changed in-so-far as they apply to theater installations, for the reason that the psychology of the theater audience must be given due consideration and the possibility of panic recognized.

No other municipal action of late years has such a far-reaching effect, and particularly does this apply to science and education, for it seems that previsualized learning is now about to come into its own all over the country, since doubtless other municipalities will make the handling of the film safer by the very simple and obvious method of putting a public watch on the operator. Nothing will do so much for teaching—the application of motion pictures to teaching has long been delayed by fire regulations—and teaching is the one human activity in which we seem not to have made the actual progress we have in other lines, though we flatter ourselves that we stand foremost among the nations of the world in educational matters.

Reagent for Detecting Free Chlorine in Water

SINCE the advent of sterilization by hypochlorites, employing generally the proportion of 0.003 parts by weight of active chlorine to 1,000 parts water, there have arisen new methods of detecting the presence of chlorine in the purified waters and estimating its quantity. The classic reagent, iodide of potassium, gives a color indication only when the water contains as much as one ten-millionth part of chlorine. A French scientist, G. Le Roy, indicates a reagent which is much more sensitive, revealing one three-hundred-millionth part of chlorine in water. This substance is the chlorhydrate of hexamethyl-triparamino-triphenylmethane. When a weak aqueous solution is added to water containing free chlorine it produces a violet color, whose intensity varies according to the amount of free chlorine.

As to the method of preparing this reagent, the author states that it can be obtained by dissolving one part hexamethyl obtained by dissolving one part hexamethyl-triaminophenyl-methane in about ten parts hydrochloric acid diluted with its own volume of water. Adding a few thousandths part of sodium chloride heightens the color produced by the reagent. Certain varieties of water give an opalescence with this reagent, and its then preferable to operate after acetification, with either acetic or formic acid, preventing this opalescence. The coloration is not prevented by the presence of nitrites or traces of hydroxyl.

Petrograd-Archangel Automobile Line

NEWS comes from Russia that an important motor truck service has been organized in that country in order to make connection between Petrograd and the seaport of Archangel. The distance between these two points is upwards of 1,200 miles, and it is stated that it takes over a month to make the trip, at least during the present conditions. When the service is organized as expected, some twenty trucks will start each day from the two ends of the line.

German Military Rifle Practice

(*Concluded from page 120*)

clause is a good one, because the man who scores a clean miss and four fairly good shots is not so good as the man holding all five on the paper, even though both scores total the same.

At 300 meters—330 yards—the soldier must score 25 points with five shots from the rest, and then 20 points without the rest.

Then he does a stunt kneeling, which is one of the hardest shooting positions human frame can assume, and one of the poorest, military gentlemen to the contrary notwithstanding.

The minimum of 20 points from the kneel at 300 meters on this many ringed target is not easy.

At 400 meters—about 435 yards—a different target is used, a sheet of paper containing three man figures set with a 10-inch interval—figures not unlike the old "pup" figure of the American skirmish target. The soldier fires over field entrenchments at this group target and is given three points for a hit in the center figure, and two points for a hit in either right or left figure. There is also a parallelogram about the center figure counting two points, while hits in the space above the figures and below them, 19 inches wide and the length of the paper count one point.

All five shots fired over this breastwork must hit the paper, and must score not less than eight points, which is not a high standard of musketry. Starting with three shots in the rifle, the recruit then fires five shots, which requires reloading via clip, in the string, one minute time being given for the string. Four shots must hit the paper, six points must be scored. A five-shot kneeling string follows, with also four hits and six points the minimum. Personally, being under the impression that I am some punkins at the rapid fire, I should much prefer the task of making the six points in the rapid fire to making them from the kneel, slow fire.

Making the requisite score at these ranges, the soldier enters the first class, and is given the acorn of the second class, the "Sign of Shot," in the form of twisted cord, black, white and red, with an acorn at the end of it, to be worn on the breast of the uniform.

The first class firing is a trifle more difficult than that of the second, but still pathetically insufficient in making what we consider first-class shots.

There is a special higher class for officers and non-coms, a sort of Teutonic Distinguished Rifleman grade, in which those hoping to qualify must make 35 points at 300 meters with five shots from rest, and so on in proportion, but never going over the 400-meter distance. These marvelous shots when they finish are given a third acorn, and a cord of black, silver and red, with a large gold "w" on a badge at the other end of the cord.

The German field firing is, in theory at least, more thorough than our own scanty instruction in this work.

The recruit is taken out into the fields and woods and is taught distance estimating and the speed of moving marks, with the theoretical lead of bullet to hit them.

Then the men in pairs are sent out to pick up various concealed targets in front of them, silhouettes of men in various positions. Actual firing on these targets is then conducted, the targets being of the automatic falling sort used in the American school of musketry, a hit in the figure releasing a catch and letting it fall out of sight. Proper taking of cover is part of this instruction.

The German does not countenance the firing at single targets by detached soldiers at ranges more than 600 meters, although he allows firing on group targets up to 1,200 yards.

Each company receives for practice 30,000 cartridges per year, but the German company runs about 300 men, and so this figures out only 100 cartridges to the man.

The whole course is marked by its paucity of ammunition allowance and the few shots necessary to qualify at a given stage. It bears all the imprint of men who have an enormous number of men to put through the course, and likewise an enormous number of men to depend upon for volume of fire in case of war.

The course is pathetic so far as the higher points of rifle shooting are concerned, while the little skill that might be gained from an ample ammunition allowance even over these restricted ranges is made unlikely in view of the ammunition allowance—30,000 rounds with a minimum of 12,000 to be expended in field firing and so but 18,000 for the target range.

The German target shooting course is precisely in line with what we know of German shooting ability, and the opinion of the British regulars is borne out by the training the troops received before they faced the short Lee-Enfields of said British regulars.

As compared to the crude if simple sight of the German, the British rear sight is provided with wind-gage and with very fine slow adjustment for making fine changes in target shooting, which does not interfere with the quick setting of the sight for ranges ordered in action. Such devices, even admitting that they cannot be used in actual warfare, encourage the men in practice to regard the weapon as an instrument of beautiful precision, encourage the men to make fine adjustments and take care in their firing to hit what they are firing at, and by encouraging care in the small details of rifle firing on the range, encourage a frame of mind that will regard as disgraceful the senseless, blind squibbing away of cartridges at the immediate landscape in front, which is a process of fire common to the infantry of most of the Powers.

Knowing the shooting ability of the soldiers of both races, knowing the care taken in their training by the officers of both armies, and knowing the almost inherited ability of the Anglo-Saxon to shoot well with a little training. I would back the splendid regular regiments of the British army of 1914 to whip handily the picked regiments of the Prussian Guard, numbers being even and siege howitzers kept out of the computation.

What Was the Greek Fire of the Ancients?

IN a recent communication to the Paris Academie, Prof. C. Zenghelis, discussing the ancient and modern literature on the so-called Greek fire, expresses the opinion that it was a mixture of nitre and various combustile substances, sulphur, charcoal, resins, oils, etc., and really the forerunner of gunpowder. The first mention he ascribes to Theophanos, about 750 A. D., who recorded that Callinicus of Heliopolis in Syria, used the fire in fighting the ships of the Arabians in 672, when Constantine IV, Pogonatos was emperor. Zenghelis does not mention that this emperor, by the aid of the fire, kept the Arabians off Constantinople when they besieged his capital in 672-678, nor does he refer to the popular belief according to which the Greek fire was known to Constantine the Great, the emperor of the first council of Nicaea (325), and was supposed to have come from China. The interesting new point, continues *The Engineer*, is that Callinicus is said to have discharged a burning mass which continued to burn under water, from a tube mounted on the prow of his ship, and that one man was sufficient to attend to this tube. Thus Gallinicus would be the inventor of both gunpower and the cannon. That nitre was one of the constituents was suggested by Berthelot, among others, but this had been questioned because nitre was not supposed to have been known in the early middle ages, though Plinius had described the efflorescence of damp walls (calcium nitrate). The composition of the Greek fire, which probably varied in the course of time, was kept a secret by the Greeks, but it was not altogether unknown later to the Saracens.

Modern chemistry, of course, knows phosphorus and some of its compounds, in metallic potassium, etc.—bodies which will catch fire spontaneously when exposed to the air or in contact with water.

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Embargo, congestion and delay are the order of the day in freight yards and terminals. The situation is rapidly becoming intolerable for business men who have heretofore depended upon the railroads for shipments between neighboring cities and over suburban districts.

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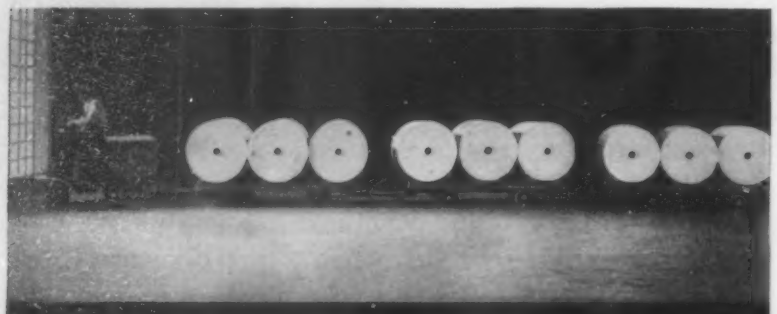

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Shorthand Systems Invented for the Chinese

A SYSTEM of shorthand writing for the Chinese language has been invented by Wong Po Koung, a member of a well-known Chinese family in Hongkong, and is now being taught by him to pupils in that city and vicinity. A speed of 140 words per minute has been made by the inventor. One of his pupils after five months' tuition has written ninety words per minute, while seventy words has been attained already by a considerable number of students.

The difficulties in the way of establishing a shorthand system for the Chinese language were thought to be insurmountable. While the language is monosyllabic and at first glance would seem to be peculiarly susceptible to shorthand work, it is never written by characters representing sound, and the same syllable when spoken in any one of the nine different tones has a separate and distinct meaning.

In the Chinese written language an idea is represented by a character made up of one or more radical or root characters which have been developed, at least to some extent, from hieroglyphics. The character is always the same for an idea, while the names of the character or the Chinese spoken word for the idea may and usually do differ in the several dialects of China. There is therefore no means of indicating a Chinese word by signs for vowels and consonants because there are no vowels or consonants in the Chinese written language.

Attempts have been made at times, both by private enterprise and through the efforts of the Chinese government which once sent a commission to Europe to study the question, to reduce the Chinese spoken language to a simply written form and even to simplify the writing so that it might be done rapidly enough to keep pace with human speech; but so far such efforts have been without practical success. One invention is an abbreviated form of Chinese writing called *Tso Shue*, or "grassy-hand" writing. It is ordinary Chinese script with many of the strokes of the characters eliminated. This form is in general use among Chinese reporters for note taking and is employed by others for hurried writing, but it has many defects. including the insufficiency of forms to represent all spoken words, the difficulty of learning the system, and the fact that writers can not keep pace with speech.

Various other systems have been invented, following the Japanese model or the Pitman method. Among inventors of other systems are Mr. Tsoi of Peking; Rev. Wong Yuk Chor and Mr. Choung Tsoi of Hongkong; while a Mr. David Jones of San Francisco also has produced one. Most of them, however, depend upon some knowledge of English and are not adaptable to the Chinese language in all its uses. In a statement explaining the new system the inventor says:

"I have altogether discarded Chinese characters. I have appropriated the signs of existing shorthand systems, with additions and modifications, and have renamed them, meeting the difficulty of lack of knowledge of the purport of vowels by incorporating the vowel sounds with the final consonants, so as to express a complete syllable with but one stroke. Thus, with one definite character representing, say, 's' and another representing 'oung,' the word "soung" is written with two strokes, and the monosyllabic nature of the language allows of every word being treated similarly. I indicate the tones by writing in position.

"First it was necessary to classify the words of the language. I found that the initial sounds of Chinese words are limited for practical purposes to 22, to which I gave distinct shorthand forms. The final sounds made up a collection of 33, each of which might occur with 9 different vowel sounds. These, too, have respective and distinct outlines accorded them. Thus, repeating the example mentioned above, one stroke suffices for any one of the sounds of 'eng,' 'ing,' 'ang,' etc. It is not necessary that the like ending words

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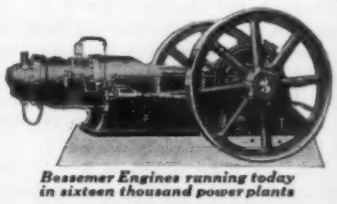

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should have any relation in their shorthand representation.

"I do not pretend that these provisions dispose of the whole matter. There are inevitable exceptions and singularities. For these I have had due regard, with particular attention to distinctness, brevity, and subsequent legibility; and I have made use of grammalogues, etc., to further facilitate speed.

"I have said that the tones are provided for by writing in position; and here, to judge from the position method of Pitman, any effort to similarly express the nine tones of Chinese might seem to threaten clumsiness and difficulty in transcribing. However, when one remembers that the tones are clearly divided into an upper and a lower register, the doubts begin to dissolve. The upper series may be written above the line and the lower below the line, which is surely but to allow the mind to follow its natural inclination. Confusion is avoided by judicious halving of strokes. Transcribing presents few difficulties, since the outlines are distinctive and any misplacement of characters in tone denominatien is readily corrected by the 'sense' of the matter, since the field of probabilities is so limited."

Chinese commercial and political life has long felt the need of an adequate system of writing the Chinese language as rapidly as it is spoken, and there is an increasing field for the practical use of the system if in general use it affords all it promises.

Drying Hog-Cholera Serum

THE Department of Agriculture has carried out experiments to test the effect of drying on hog-cholera serum, by subjecting the serum to freezing and drying in vacua, according to a method originally developed by Harris for the preparation of antirabic vaccine, and later applied by Rogers to the drying of cultures of *Bacillus bulgaricus*. Tests of the serum thus prepared show that its antitoxic properties are not impaired by drying, and that pigs treated with the dried material, taken up in water before injection, are completely protected against hog cholera.

A Great Telescope for Argentina

A SITE near the southern extremity of the Sierra Chica, about 25 miles southwest of Cordoba, has been chosen for the reflecting telescope of 1½ meters (59 inches) aperature, now in course of construction for the National Observatory of Argentina. The new observatory will be erected in the course of the next year. Director Perrine states that the present observatory at Cordoba will be retained, in addition to the new one.

Insects in Relation to Forest Fires

INVESTIGATIONS by the U. S. Bureau of Entomology have brought out an intimate interrelation between insects and fires in the damage and destruction of forests. Injuries by insects make the forest more susceptible of damage by fire, and *vice versa*. Areas of insect-killed timber are more inflammable than the forest in general. On the other hand, fire-wounds furnish favorable points of attack for wood-boring insects. These and other analogous facts indicate that the control of forest insects is an important step toward the prevention of forest fires. Moreover, insects are the primary cause of the death of more merchantable-size timber than are fires.

Peevishness in the Coast Survey

THE building occupied by the Coast and Geodetic Survey in Washington can hardly be called a hovel. It is three stories in height and it is kept neatly painted on the outside. In contrast, however, to the splendid marmoreal edifice on the opposite side of the street, in which each and every Congressman enjoys the use of a private apartment in keeping with the emoluments which our legislators have allotted to themselves, the home of this admirable scientific institution might be described as humble. Hence it serves

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Hudson Super-Six

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It has won all the stock-car records which can demonstrate supremacy. It has excelled in all feats of endurance.

It gives to the Hudson a pinnacle place, which rivals have not equalled.

It is vital that you know why. There is a medley of types—Sixes, Eights and Twelves—all opposed to the Super-Six. You must know the facts to form judgment.

Friction is the Foe

Why was the Six-type adopted?

Why was the heavy Six abandoned for the small-bore Light Six type?

Why did the Light Six—in 1915—seem to be a waning type? Why did many leading makers, including the Hudson, test out Eights and Twelves?

The answer to all is Friction. Too much power was wasted through motor vibration. Too much wear was caused by the resulting friction.

That was the Light Six limitation. And the trend toward V-types was an effort to reduce it.

The Best Solution

Hudson engineers, in the Super-Six invention, offered the best solution. They kept the Light Six. But they added 80 per cent to the motor's efficiency by reducing the vibration.

The Super-Six isn't perfect. It doesn't completely end friction. If it did we should have perpetual motion.

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The amazing records made by Hudson Super-Six have all been due to super-endurance.

Even its speed records—as high as 102.56 miles per hour—were due to absence of motor friction.

It broke the 24-hour record by 52 per cent. It won the Pike's Peak hill-climb. It twice broke the ocean-to-ocean record in one continuous 7000-mile round trip.

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the useful purpose of setting off, by its humility, the beauty of the Capitol and of the group of monumental structures growing up around it. It diversifies the landscape, threatened with becoming monotonously palatial. That is one reason for not pulling it down. Another is that sooner or later it will probably disintegrate of its own accord, thus saving the expense of demolition.

Why then does the director of the Survey, in his latest annual report, plead so tearfully for a new building? His arguments seem sadly biased, and he ignores several excellent reasons for putting up cheerfully with whatever trifling inconveniences may arise from continuing to occupy the existing premises.

The main building of the Coast Survey was erected in 1871, and was designed along the lines of a hotel of that period. It was, in fact, intended to be used as one after temporary occupancy by the Government but the Government is still there, and ideas in hotels have since changed for the better.

"The rooms are small," says the director, "with numerous recesses for the accumulation of dirt; the windows are of the old-fashioned small-pane type, difficult to reach from the outside and hard to clean; all the floors are of wood, and worn."

What of it? Does not everybody know that scientific men love to work amid dingy surroundings—resent the intrusion of housemaids and charwomen—and derive from dusty tomes a joy that no spick-and-span new book can furnish?

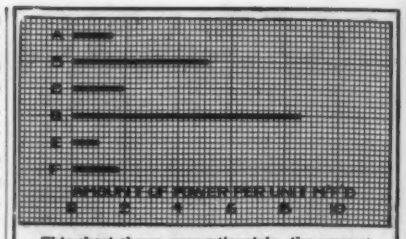
Quoting again: "The Butler Building (an adjacent structure which the Survey shares with the Public Health Service) including the basement, is five stories high. In the basement of this building are stored the copper plates from which charts are printed. These plates must be carried from the storage vault to the engravers for corrections and additions of information, an average distance of 300 feet, and up seven flights of stairs. There are approximately 2,500 of these plates in the vault, and while an exact count of how many trips are made back and forth in the course of the year has not been kept, yet it is probable that these trips number over 3,000."

Is there no pleasing this man? In one breath he complains of surroundings detrimental to health and in the next of the necessity under which his subordinates find themselves of taking daily physical exercise, by which health may be maintained. The wonder grows when we learn that each plate weighs 42 pounds. The Butler Building, by the way, is historic as the former abode of Gen. Benjamin Butler, whose memory is hallowed in New Orleans. Director Jones is so lacking in sentiment as to suggest the installation of an elevator in this venerable five-story building, where it would, of course, be an architectural enormity, and withal far too modern.

Mr. Jones may be oblivious to the soaring cost of paper, but we are not, and therefore we cannot follow him further in his prolonged tale of woe, printed at the expense of the Government to appraise Congressmen of facts that they could easily ascertain by merely stepping across the street. His plea will probably be in vain. The decisive *raison d'être* of the dark, dirty and dilapidated building of the Coast Survey is the joy which Congressmen derive from gazing over at it from the House Office Building and congratulating themselves that they do not have to occupy it.

International Commission on Zoological Nomenclature

THIS is one of the few international scientific bodies that has kept up its work in spite of the war. Prof. C. W. Stiles of Washington is secretary, and the expenses of his office are paid by the Smithsonian Institution. The commission is rapidly building up an official list of recognized generic names, with the genotypes upon which they are based. During the past year a single "opinion" of the commission (No. 67) placed the names of 102 genera of birds on the official list.



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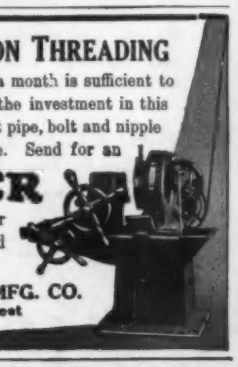

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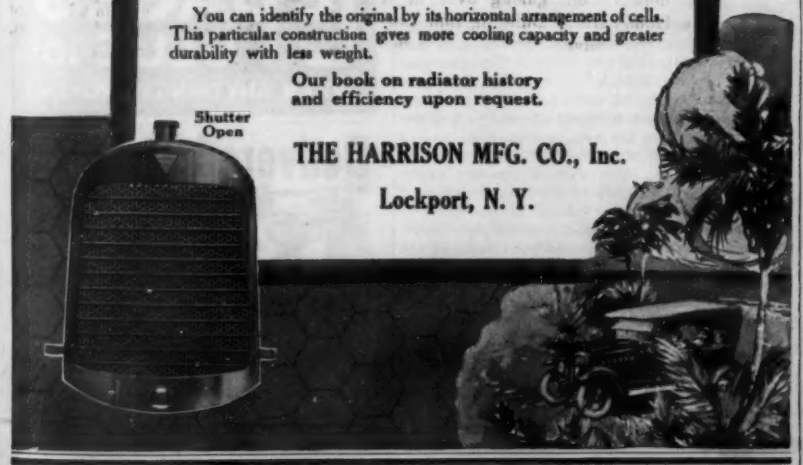

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(14184) E. S. K. asks: Will you kindly inform me how emblems, curiosities and other devices are put inside of bottles, the necks of said bottles seemingly appearing too small for the admittance of said objects? Are there any books written on such work, and if so, where could I obtain same.? A. We have seen very remarkable work of the sort you describe in glass bottles, but have always supposed the articles had been put together in the bottle piece by piece by some very patient and skilful person. We do not know any other way of doing such work.

(14185) M. B. F. asks: I would like to get some books or articles on the reflection of electrical waves, especially something dealing with material used and a result of the experiment. A. A simple presentation of the reflection, refraction, polarization, diffraction and absorption of electric waves by experiments is to be found in Thompson's "Light, Visible and Invisible," which we will send for $1.90 post paid. It is contained in the Chapter on the Ultra-violet part of the Invisible Spectrum, pages 214-238. We have made the apparatus from the descriptions and performed the experiments successfully.

(14186) L. W. G. asks: I believe that diamonds, after they have been taken from the ground sometimes explode, but I am not sure under what conditions. Must the explosion, if it takes place, be immediately after removal from the ground, or, may it occur months or years afterward? Have cases ever been known where such explosion has taken place after the stone has been cut? Is the stone by the explosion sometimes torn into minute fragments? A. We have read that diamonds may split into pieces when they are first taken out of the earth, but we have no knowledge in reference to the matter. Perhaps some reader can supply definite information upon the point.

(14187) J. A. P. asks: Will you please give me a formula which can be used to make photo sculpture reliefs, to be used for plaster cast molds. Something of a gelatine composition charged with a chemical sensitive to light, so that the exposed parts can be washed out, leaving a relief. A. Bichromated gelatine, which is sensitive to light, is prepared by dissolving bichromate of potash in hot water, and gelatine also in hot water. The two solutions are stirred together. The mixture becomes insoluble upon exposure to light. When an exposure is made the exposed parts become insoluble, and the unexposed parts may be washed out in water, not the exposed parts, as you state. The proportion of bichromate may vary widely for different uses.

(14188) G. M. M. asks: Does any of your back numbers contain any articles on the recording processes on cylinder- or disk-talking machines? If so, how many copies are containing such articles? If there are not more than ten or so, you may send them right on and I will remit for same. In case there are more, send the ten most important ones only, and give me an idea as to what the other articles are about in detail. I would also be interested in the making of discs, and their composition. A.—We can supply you with a paper upon a microscopic study of the tracing on a phonographic record in the SCIENTIFIC AMERICAN, Vol. 113, No. 20, price 10 cents, but we have no papers dealing with the making of the cylinders and discs used for the records. For such information we must refer you to the companies making the phonographs and the records.

(14189) C. W. R. asks: Recently there was brought to my notice the following problem in physics, and I would greatly appreciate your kindness if you will send me your solution to this question.

A cylindrical cork 3 c. m. high, 2 c. m. in diameter, density 0.25, is sunk first 10 then 20 c. m. in a liquid 0.8 density. How hard would it push upward at the two levels? A. The solution of the problem in physics which you send us is as follows:

Area of end of cork ΠR^2 =	3.1416 cm^2
Volume of cork, ΠR^2 length =	9.4248 cm^3
Weight of cork, ¼ of vol.	2.3562 gms
Weight of = vol. of water	9.4248 gms
Weight of = vol. of liq. dens. 8 =	7.5398 gms

Buoyancy of cork in liquid of density .8, is the difference between the weight of the cork, and of the equal volume of the liquid, 7.5398—2.3562 = 5.1836 grammes. The upward pressure would be the same at both depths unless the pressure of the liquid reduces the volume of the cork, in which case the cork would displace less liquid while its weight would remain the same, and the upward pressure would be less. There is no way of determining how much the cork would be compressed at any depth, since its compressibility is not given. Any liquid is incompressible by so slight an increase of depth, and the upward pressure is not affected by so slight a change of depth. The principle of Archimedes is "A body immersed in a fluid is buoyed up by a force equal to the weight of the liquid displaced." This covers all cases of submerged bodies.

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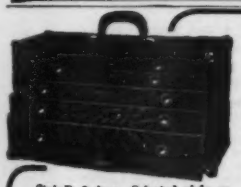

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(14190) W. P. B. asks: Will you kindly give as much space as you can spare in an early issue of SCIENTIFIC AMERICAN on "The Ice Age" that covered the North American continent, its age, duration, cause effect on landscape, vegetable and animal life and other information. A. We are not aware that there is any new information upon the subject of the "Ice Age in America or Europe" which we could publish, and so we beg to refer you to the books already published upon the subject: "Wright's Ice Age in North America," price $5; "Wright's Man and the Glacial Period," $1.75; "Tarr's College Physiography," price $3.75. This last has long chapters upon Glaciers and the Glacial Period, which may give you all you wish to know about this topic besides containing a great deal about other features of the earth and the atmosphere. We shall be pleased to supply you with any of these books at the prices named.

(14191) S. B. B. asks: Has it ever been determined what chemical action causes petrification in wood and other substances. If it is a chemical that is in the soil, how do they account for trees becoming petrified standing up, as in the case of the petrified forests found in the United States? A. There are two modes of forming fossils. In one the forms are incrusted with mineral matter and the entire interior is of stone without preserving the details of internal structure. The great majority of vegetable fossils are of this kind, and the term "incrustations" is the general term to cover this mode of formation. The second mode of formation is by the replacement of the material by a mineral substance. Then the interior structure may be preserved. This method gives rise to "petrifications." The calcium carbonate of a shell or the vegetable matter of a log may be replaced by silica and the details of structure of the former state be fully preserved. It is necessary that solution should precede petrification, a substance insoluble in water could not be taken away nor could a substance insoluble in water be brought in to take the place of the matter removed. This is the general mode briefly stated. The text-books of geology give the matter more fully. We can furnish you with Chamberlain and Salisbury's for $3.80.

(14192) P. M. asks: A friend and myself are planning to do some work in organic chemistry during the coming summer, and would like to know more about the possibilities of manufacturing chemicals. We are going to have our own laboratory, and wish to keep up running expenses by some small scale manufacturing. Are there not some processes which are commercially profitable, but which cannot be carried out on a large scale? Something in the line of dye substances. Also, could you tell us if there is a good market for para toluidine? We would also like some hints as to the best fields for research, and the names of any good chemical magazines published in this country. If you have any literature, which would throw any light on these subjects, we would be much obliged for it. A. Replying to your inquiry we would say that you are living in a university city, and the easiest and best way for you to obtain the information you seek is to see the professor in the branch of chemistry you wish to take up and he will doubtless be interested in your proposition. He can help you better than any one else whom we can suggest. We do not know your training, capabilities or equipment for work. You should be able to arrange with the professor for working in the University laboratory in the summer school which is one of the best in the country, under the guidance of competent instructors, and thus be saved much time and expense in getting at your results. We can supply you with any books you may require, but cannot decide for you what you require. There are many books from which to select.

(14193) F. H. H. asks: What is the universal compulsory military training, that high Army and Navy officials and national defence leagues are making so much noise about; also are you in favor of it? 2. Is there any difference between a dreadnought, a battleship, a battle-cruiser? If so, what is the difference; if not, why are they spoken of in different terms? 3. What is the relative strength of, iron, wrought iron, steel, concrete reinforced, and wood? A. 1. Inasmuch as it has been found impossible to maintain the Army and the Navy at anything like adequate peace strength, or to keep a trained reserve worth the name through voluntary enlistment, it is necessary to start some other system. The failure of our present system, due to whatever causes it may be, necessitates a compulsory system. Although no system has been formulated as yet, the probable results will represent the adoption of several systems, namely the Swiss, the Australian, etc. This probable system will undoubtedly include physical and military training in the lower schools with summer camps and one or two years with the colors upon the completion of the common-school courses, and then a specified number of years with the first, second and third reserves with a certain amount of yearly camp work with each. An adequate Army and Navy is essential to the welfare of the United States. If they are obtainable only through compulsory service we are most emphatically in favor of the compulsory service. 2. A "dreadnought" is the type of capital ship which immediately preceded the "battleship." A "battleship" is much more heavily armed and armored and is much slower than a "battle-cruiser." 3. The ultimate tensile strengths of the materials in question are about as follows: Iron (cast), 20,000 pounds; wrought iron, 50,000 pounds; steel, 80,000 (structural taken as 60,000) pounds; reinforced concrete, varies with the amount of reinforcement used; wood, (open to wide variation), 20,000 pounds.

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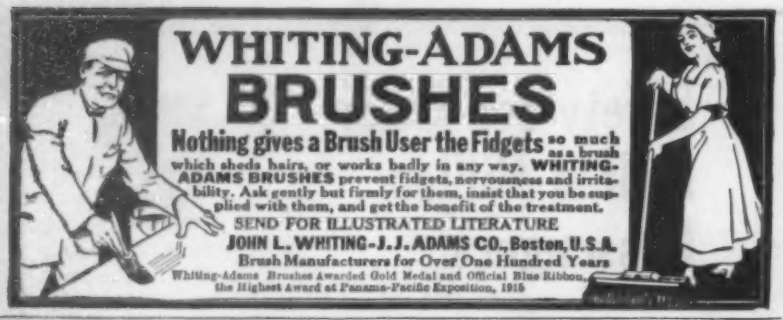
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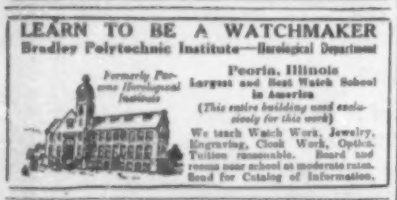
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NEW BOOKS, ETC.

PREHISTORIC MAN. By W. L. H. Duckworth, M.A., M.D., Sc.D. New York: G. P. Putnam's Sons. 12mo.; 156 pp.; illustrated.

In this slender volume is summarized much of the evidence dealing with the earliest phases in the history of mankind. This summary covers Palaeolithic man and his precursors, alluvial deposits and caves, associated animals and implements, human fossils and geological chronology, and human evolution in the light of recent research.

AUTOMOBILE WELDING WITH THE OXY-ACETYLENE FLAME. By M. Keith Dunham. New York: The Norman W. Henley Publishing Company, 1916. 12 mo.; 167 pp.; illustrated. Price, $1.00.

Since the introduction of this process of welding some ten years ago, its merits have come to be generally recognized. The treatise in hand points out where the process can be successfully applied, sets forth the general principles in an intelligible manner, and has specific chapters on the handling of the various metals. Users of the oxy-acetylene flame will find it very useful in acquiring a working knowledge of the fundamentals for successful repair welding.

HOW BOYS AND GIRLS CAN EARN MONEY. By C. C. Bowsfield. Chicago: Forbes and Company, 1916. 8vo.; 247 pp. Price, $1.

Most boys and girls need what they can earn in their spare time—and those who do not are more to be pitied than envied. Such occupation builds up habits of thrift, stimulates ambition, and often reveals a fitness for some particular kind of work that helps in the selection of a vocation. In this book the author presents many thoroughly practical plans, from making labels to raising pop corn. Parents will find it an excellent work to place in the hands of the young, or in which to find suggestions that they themselves may pass on and elaborate upon.

TEMPERA E CEMENTAZIONE DELL' ACCIALO By Mario Levi-Malvano. Milan: Ulrico Hoepli, 1917. 16mo.; 273 pp.; 66 illustrations. Price, L. 4.

IL MECCANICO MODERNO. By A. Massenz Milan: Ulrico Hoepli, 1917. 16mo.; 375 pp.; 331 illustrations. Price, L. 4, 50.

The demands made upon the quality of steel by modern ordnance and armor and by the automobile and the aeroplane have been met by the development of old processes and the discovery of new. *Tempera e Cementazione dell' Acciaio* is a concise historical and contemporary review of this evolution, tersely describing instruments of investigation such as the microscope and the pyrometer, and carefully explaining requisites and methods for the operations that give the book its name. *Il Meccanico Moderno* offers to the industrial school and the workshop a handy guide, compact yet explicit, prepared by a well-known technologist, and lavishly illustrated.

HUMAN PHYSIOLOGY. A Text-book for High Schools and Colleges. By Percy Goldthwait Stiles, Assistant Professor of Physiology in Harvard University. Philadelphia: W. B. Saunders Company, 1916. 12 mo. 405 pp.; illustrated. Price, $1.50 net.

Professor Stiles claims for his work the modest aim of concisely stating accepted facts, with but limited descriptions of the experiments that establish these facts. Such, indeed, must be the characteristics and the limitations of a text intended for school and college, or the elementary student would be bewildered instead of enlightened. The author's fitness for his task is revealed in what he has left out, as much as in what is included; his prefatory remarks to the teacher recognize the fact that the student's difficulties arise less from the complexities of anatomical organization, which is readily illustrated and visualized, than from the need of understanding molecules and forces—chemistry and physics. This viewpoint will give the key to the points of emphasis in the text, which strives to replace vague ideas and the mere repetitions of memory with large conceptions and well-assimilated detail.

THE SCIENCE OF RELIGION. Fundamental Faiths Expressed in Modern Terms. By Daniel A. Simmons. New York: Fleming H. Revell Company, 1916. 12mo.; 224 pp. Price, $1 net.

Judge Simmons here makes an earnest attempt to reconcile the basic tenets of science and religion, and he has produced a thoughtful work that should be on the whole most salutary in its tendencies and effects. Both the weakness and the strength of the work lie in its efforts not to antagonize the dogmatists of faith or the dogmatists of religion; yet it would be remarkable if the book did not alienate extremists of both cults. Perhaps the greatest value it possesses is that of reminding science of the mistakes its materialistic bias has made for it in the past, at the same time pointing out to religion its foredoomed failure so long as it persists in wrapping its truths in the cerements of discarded superstitions, fearing, or at least refusing, to meet the arguments of materialism on their own ground. At any rate he gives us some inspiring speculation based upon science's own findings, shows us that there is at least room in the universe for a refined matter undiscoverable by the physical senses, and suggests ways of extending the frontiers of science that might eventually lead to an acceptance of the persistency of personality after death

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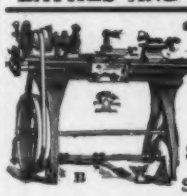
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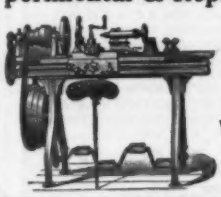

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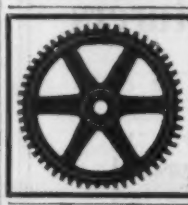

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SCIENTIFIC AMERICAN

ABOARD THE MERCHANT SUBMARINE "DEUTSCHLAND"

Captain Koenig at the Periscope

A drawing from life made by Henry Reuterdahl, the well known marine artist, who is the only man ever permitted to make sketches within the hull of the Deutschland. Captain Koenig, who has never before posed before an artist, consented to don his navigating garb and stand at the periscope in order to give the Scientific American a true conception of working conditions aboard the vessel when under way.

A key to this picture, with the names of all the details of this complex mass of machinery, will be found on page 151.

February 10, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Industrial-America First

SCIENTIFIC AMERICAN

February 17 — March 17

ALTHOUGH the present war has been the most ***destructive*** in the world's history it promises at the same time to be the most ***constructive***. Behind the fighting men of Europe on each side, there are vast industrial organizations. These are being carried on with the highest efficiency that their men of science can develop. When the war is ended we shall have a different competition to meet from that which we have encountered in the past. This is already being realized by many of our manufacturers and a great deal of activity is now being displayed in the development of new industrial methods and the use of scientific research. Not much has been written about these advancements in manufacturing processes. Realizing this lack of information, the SCIENTIFIC AMERICAN has planned a series of

Industrial Issues

In these issues, the SCIENTIFIC AMERICAN is but complying with its well recognized obligation, viz.: to announce the latest developments in scientific, mechanical and industrial progress for the benefit of manufacturers and business men.

Two special industrial numbers will shortly be published, one on February 17th and one on March 17th. The first one will contain a discussion of the research facilities in this country, giving practical examples of the work that has been done by one of our important research bureaus. It will show what can be done when the man of science and the manufacturer are brought together. There is no reason why this country with its enormous resources, its wealth, and its intelligent people, should not become the world center of applied science. Further examples, with articles written by the men who have actually conducted such research work, and publishing for the first time their marvelous discoveries, will be found in the issue of March 17th.

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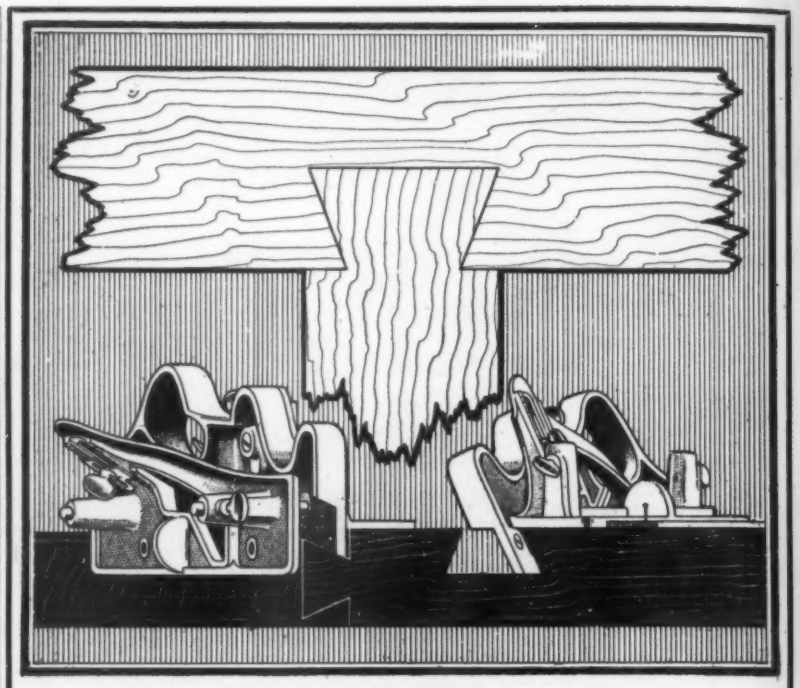

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Not only common dovetail joints as shown in the illustration above, but irregular dovetail joints of all kinds can be made with its use.

The operations are simple, and the accurate, perfect fitting joints obtained, both parallel and tapering, will convince the operator of the utility of this unique and original tool.

A booklet containing complete description of the Plane, as well as valuable suggestions as to the use of dovetail joints, will be mailed upon request.

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